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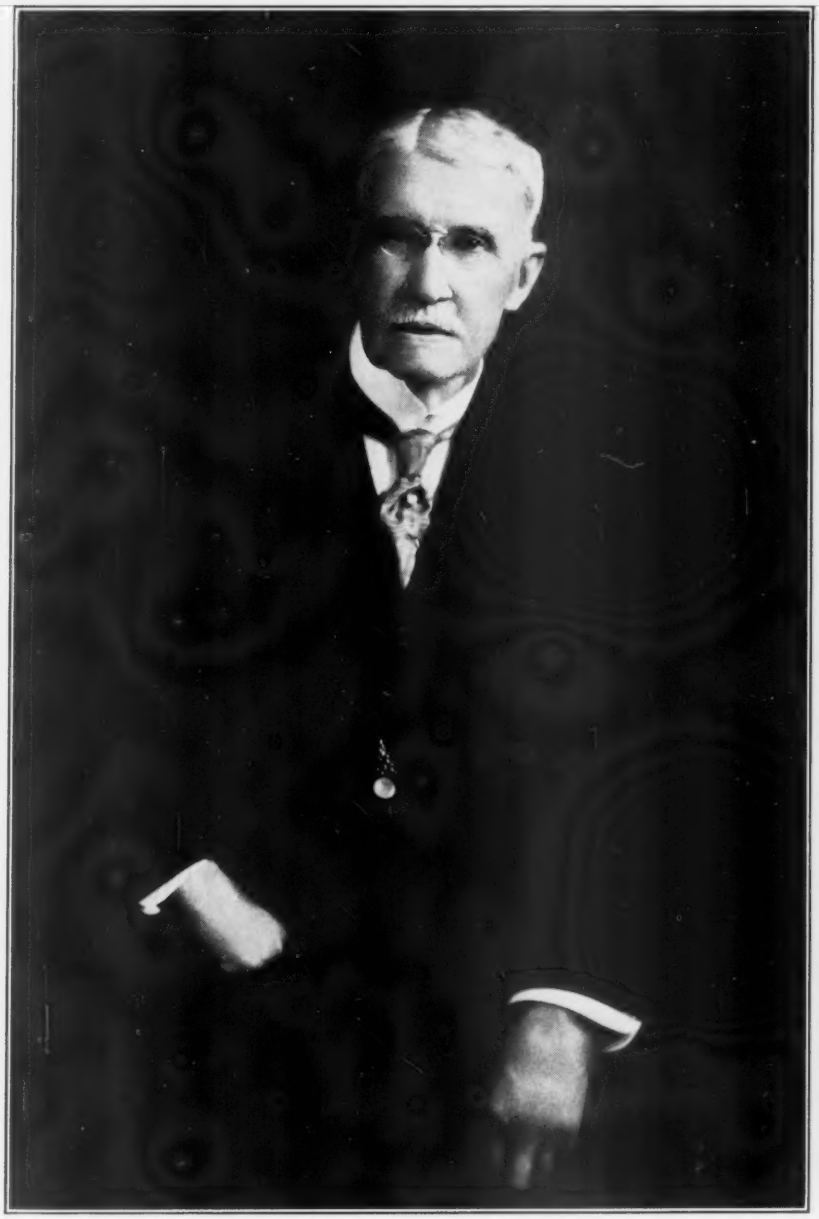

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For story of Mr. McBean, see page 314.

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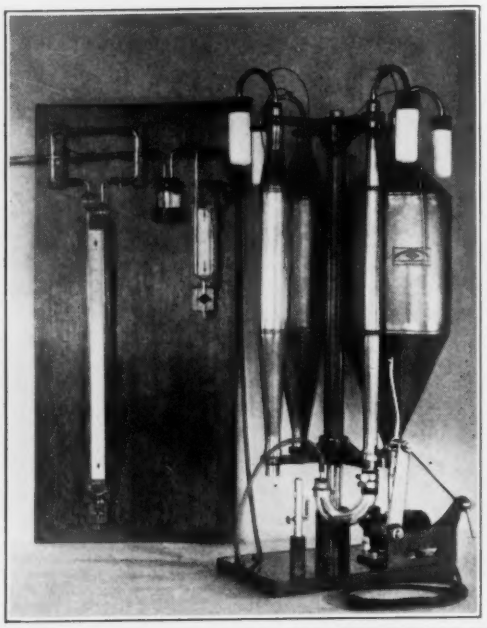

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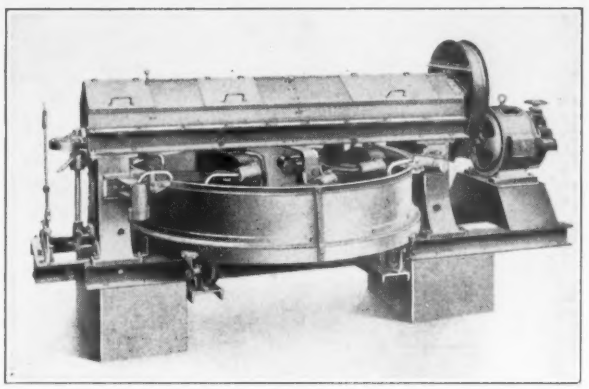

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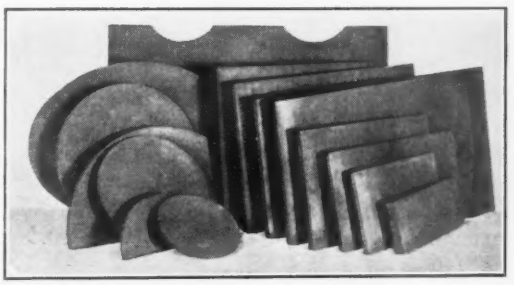

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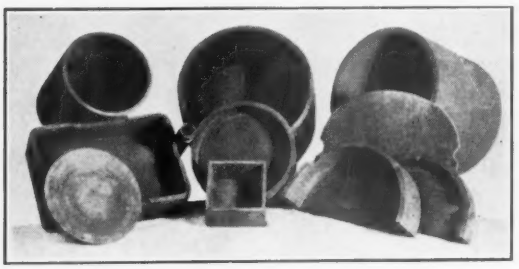

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The October, 1936, number contains 27 other papers presented at the Congress.

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Cryolite (see Kryolith)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.
Bethlehem Steel Co.

Enameling Muffles
Bethlehem Steel Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)
Pittsburgh Plate Glass Co.

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The DeVilbiss Co.
The Hommel Co., O., Inc.

Exhaust Systems
The DeVilbiss Co.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
Sant, Richard C.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Spinks Clay Co., H. C.

Flint
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

French Flint
Consolidated Feldspar Corp.
Paper Makers Importing Co.

Frit
Allied Engineering Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Frazier-Simplex, Inc.

Furnaces
Allied Engineering Co.
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Pots (Open and Covered)
Pittsburgh Plate Glass Co.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.
Pittsburgh Plate Glass Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. H. Chemicals Dept.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Goggles
Cover, H. S.
Willson Products, Inc.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. H. & Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Dept.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Co.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Crystolon*)

Hearths (Fused Al_2O_3, SiC)
Electro Refractories & Alloys Corp.

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hose (Air and Fluid)
The DeVilbiss Co.

Iron (Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
Sant, Richard C.
United Clay Mines Corp.
The Vitro Mfg. Co.

Kellog AA Refractories
Electro Refractories & Alloys Corp.

Kilns, China (Decorating)
Allied Engineering Co.
Denver Fire Clay Co.
Drakenfeld & Co., B. F.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide)
Electro Refractories & Alloys Corp.
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Corhart Refractories Co.
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Drakenfeld & Co., B. F.
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The Hommel Co., O., Inc.
The Vitro Mfg. Co.
Non-Gro Refractories
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Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
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Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
Palladium Decorations
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The Hommel Co., O., Inc.
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Titanium Alloy Mfg. Co.
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Electro Refractories & Alloys Corp.
Kentucky-Tennessee Clay Co.
Norton Co.
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Sant, Richard C.
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Willson Products, Inc.
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Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
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Metal & Thermit Corp.
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The Vitro Mfg. Co.
Saggers
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Selenite of Sodium
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.
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Ceramic Color & Chemical Mfg. Co.
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The Vitro Mfg. Co.
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The Hommel Co., O., Inc.
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Pittsburgh Plate Glass Co.

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Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
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Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.

Tile (Wall)
Denver Fire Clay Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc.,
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Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc.,
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Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
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Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
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Montgomery Porcelain Products Co.
Norton Co.
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Chicago Vitreous Enamel Product Co.
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Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Whiting
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Paper Makers Importing Co.
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Winding Drums
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The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Zirconia
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Du Pont de Nemours, E. I., & Co., Inc.,
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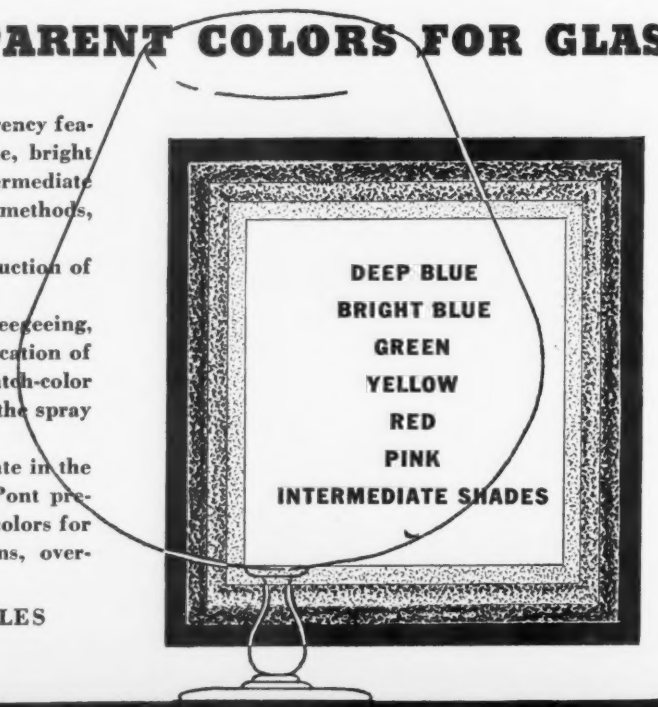

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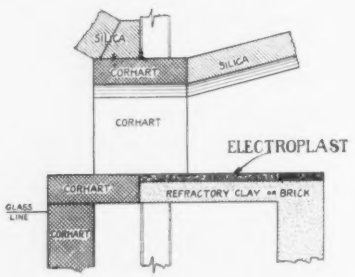

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EDITORIAL

AN ARCHITECT LOOKS AT CLAY*

By Theodore Irving Coe

That familiarity with the common and everyday things clouds our appreciation of their true value and importance has been expressed with poetic analysis by a skilled weaver of words who said,

"As when we gaze upon a word we know, repeating, 'till the word we know so well, becomes a wonder, and we know not why."

If we, with less poetic felicity, paraphrase this thought to apply to the subject of our consideration, we may truly say that as we gaze upon the clay we know so well, recalling the antiquity of its discovery, man's accomplishments through its use, and the possibilities for its further development, it becomes one of the most wonderful of nature's contributions to the use, welfare, and enjoyment of mankind.

As we strive to penetrate the haze of unrecorded history and glean truth from the uncertainties of conjecture, there is little of the improbable in the thought of the hands of men of the earliest Neolithic era instinctively seeking contact with "Mother Earth" and, without conscious creative effort, forming the crude utensils which served the needs of simple living.

Even in his primitive state, man must have observed his earthen utensils become firm and hard as they were exposed to the sun's heat or the fire which warmed their contents.

Since the timid emergence of men from the shelter of caves, clay has had an increasingly important part in the solution of the problems of housing, which then had their beginning. As nation after nation emerged from the shadows of primitive existence, each added the touch of individuality as it adapted clay to the needs of its skill and material necessities. It became the forerunner of the harder stucco and played a no mean second fiddle in "wattle and daub" construction, the humble seed from which grew the mighty cathedral and the lofty skyscraper.

In the simple differences in the shades of natural clays, which became more varied and pronounced as firing was substituted for sun-drying, we may trace the origin of color variation in buildings; this reached its highest development as clay responded to the inspiration of creative genius.

Herodotus, that voluble early traveller, tells us that the temple of Bel at Babylon was in eight steps or stages of different colors with ramps from stage to stage and that it was 600 feet across each side at the base and 600 feet in height, with a shrine at the top.

We still follow the economy of construction originated by these early builders who backed up the facing of hard brick with a crude form of sun-dried brick. Long before the architects of Greece had evolved their graceful structures of marble with stately colonnades, ornamented entablatures, and pediments, they used sun-dried brick for walls, and their roofs of wood, supported on wood posts, were protected by clay tile and ornamented with decorative terra cotta. Even the lordly Romans did not scorn the use of brick or of terra cotta which, in their hands, profited in technical excellence, if not artistically.

In the use of color and the decoration of sur-

* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 23, 1937 (Structural Clay Products and Terra Cotta Divisions).

faces, the skill of oriental craftsmen found in clay the medium which fully responded to every artistic demand, and it was the early Persians who established a standard which continues to serve as a pattern and inspiration to the workers in clay who followed them. As the Roman Empire expanded and established orderly government in conquered provinces, the art of the worker in clay spread over an ever-widening area to be checked and almost suffer extinction with the fall of the Empire and the advent of the dark period of medievalism which followed.

During the conditions of poverty of the people, difficulties of transportation, and scarcity of skilled workmen, which were characteristic of the medieval period, the availability, economy, ease of production, and structural and decorative possibilities of clay, as a building material, were more clearly recognized. It was clay that fashioned the structure and decorative features of many outstanding buildings of the Gothic period in Germany and Italy.

With the coming of the Renaissance and the advance in culture, art, and craftsmanship which it signified, clay continued to exert its influence in the structural and decorative fields of construction.

Notwithstanding the antiquity of its use, its adaptability to the needs and uses of men found clay ever capable of meeting the conditions of change and the competition of newer materials and techniques of building.

We are standing today at the cross-roads of construction progress and development; on the one hand, there is the pressing need for increased activity throughout the building industry and, on the other, the demand for lower costs of construction to encourage such activity. It is the need of housing for the millions of our fellow countrymen who cannot now provide healthful and adequate home accommodations, within the limits of their ability to pay, that has aroused nation-wide interest and the most intensive effort to find a practical solution. Innumerable ideas, plans, schemes, and projects have been conceived and pushed forward with the assurance of proud parents exhibiting youthful prodigies.

New materials and methods of construction are advanced while older materials, in some cases, have been hurried to the beauty parlors for face-lifting and other rejuvenating treatments. Wishful thinking has rubbed an Aladdin's lamp and visualized ready-to-wear homes, like automobiles, enjoying the advantages of mass production.

The mountain has indeed labored and, so far, brought forth the Lilliputian home trailer which now begins to dot the highways and seek rest here, there, and yonder.

In an era that shows little respect for age and is suspicious of tradition, there are many who will not be convinced that a slow-moving past can aid in the solution of the problems of a fast-moving present, but it should not be forgotten that the most outstanding advances in the use of clay are not related to the accomplishments of our boasted age of machinery but have come to us from the art and skill of the ancient people of many lands. In this fact there lies a challenge, but there should also be inspiration as we confront the problems of today and tomorrow in the field of construction. Let us, therefore, not fail to consider the past as we peer into the future or forget the old adage, "familiarity breeds contempt," lest we overlook the possibilities still inherent in ancient clay to meet the requirements of today and tomorrow, as it has the needs of yesterday.

In solving the earliest of housing problems, clay made a definite place for itself, and it seems quite fitting that it is now the problem of housing that presents the opportunity for the further development of clay as an economic factor in the advancement of housing construction.

From the standpoint of durability, low maintenance costs, fire resistance, and defense against the corrosive action of time and the elements, clay enjoys an enviable reputation. With its adaptability to serve acceptably the requirements of structure in varied forms and an infinite variety of ornamental and decorative treatments are combined the advantages of ease of handling and the widespread range of its production.

It works coöperatively with other materials, especially structural steel and reinforced concrete in combination with which floor and roof beams can be prefabricated on the site and floor and roof construction erected without special form work.

Above all things, it should be permitted to speak its own language and tell its own story for it has suffered when it has been compelled to masquerade as something it is not.

From the standpoint of those who shrink from tiresome repetition in building design, the adapta-

bility of clay provides flexibility in meeting varying planning and construction requirements and responds to the desire of the architect to avoid the monotony of too rigid a standardization and the mechanical characteristics associated with mass production. The march of progress may be temporarily halted, or mark time, but it will continue to move forward. Technical science retires to the laboratory and transforms by-products from the waste pile into materials of usefulness and beauty, thus widening the field of selection for those who design and build buildings.

The effort to solve the problem of bringing the costs of construction within reach of 80% of our wage earners, representing the potential market for housing of reasonable cost, will continue to make progress. In the solution of this problem, clay will need, as it deserves, the united effort of those interested in every phase of its production for use in building construction.

The products and development of an earliee era should not of necessity be accepted as thr answer to the problems of today, but the knowledge of clay which has been gained through centuries of use furnishes an exceptional background and starting point for further development aided by forward-looking technical science and modern mechanical skill.

With the guidance of such technical and mechanical advancement, we feel confident that this age-old material will take on new vigor and be found in the vanguard of the materials which will serve the needs of changing times and conditions and that it will play its part in increasing construction through economies in building costs.

It is the history of its past that encourages this hope for its future as "An Architect Looks at Clay."

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COLORS FOR SAND-MOLD BRICK*

By F. E. Lobaugh

Abstract

A study is presented of various colors of soft-mud brick produced by mixing coloring agents in the molding sand. Sand and clay of the Hudson River district of New York were used, and the test pieces were fired under oxidizing conditions.

I. Introduction

The increasing demand for buildings of Colonial architecture has encouraged progressive manufacturers to install machinery for the manufacture of brick by the soft-mud process. The soft mellow tones obtained by this method of manufacture are not duplicated in any other way. It is the purpose of this paper to show what can be done to produce a range of color and more desirable colors than are now obtained from the clay and sand available in the Hudson River district and to show that these colors can be produced under conditions that can be duplicated in scove kilns.

II. Materials

(1) The Sand

The Hudson River molding sand is yellow and very fine. It contains 14% of hard particles of sand which are retained on a 10-mesh sieve. This was discarded and the remaining 86% easily passed a 50-mesh sieve. The screen analysis is as follows:

Mesh screen	(%)
65	1.22
80	2.00
100	5.24
150	15.84
200	20.36
Through 200	55.34

From this analysis, it is seen that the sand is very fine, 91.5% having passed through 100-mesh screen.

The chemical analysis is as follows: silica 77.2%, calcium oxide 1.6%, iron oxide 2.6%, alumina 11.7%, magnesium oxide 0.3%, titanium oxide 0.9%, and ignition loss 2.5%. Sodium and potassium were not included in this analysis.

* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 23, 1937 (Structural Clay Products Division).

(2) The Clay

Geologically, the clay is an estuarine clay of the Pleistocene epoch. Of this clay, Ries[1] says,

"Throughout the extent (Hudson River), the clays present the same marly clay of a blue-gray color except where the beds are weathered, the color then being yellow, owing to the presence of limonite. The clays contain a great quantity of fine grit and a large amount of clay substance. The fine grit is not uniformly distributed throughout the clay but is in thin layers which cause the clay to split very evenly and readily. These clays are sticky when mixed with water but they can by no means be considered highly plastic."

The porosity of this clay, when fired, varied little at the lower temperatures, decreasing from 30.8% at cone 012 (1540°F) to 28.3% at cone 02 (1940° F). At cone 1 (1987°F) the porosity was 4%, at cone 2 (2014°F) 1.3%, and at cone 3 (2037°F) 0.0%. This shows a decrease in porosity of 2.5% from 1540° to 1940°F.

The total volume shrinkage at cone 1 was 26.1%. This test was made in a small experimental kiln and the clay pieces were fired for 24 hours.

(3) The Coloring Agents

In choosing the coloring agents, an effort was made to use the least expensive materials, but in a few cases moderate-priced ones were used.

The soluble compounds were copperas (ferrous sulfate), ferric chloride, and manganese chloride.

The insoluble coloring agents used were hematite, red oxide A, manganese dioxide, black flash, chrome oxide, iron chromate, black iron oxide, powdered blue, magnetite, limonite, burnt umber, whiting, hydrated lime, Monmouth clay, Venetian red, and yellow ochre. The coloring agents were added in various amounts ranging from 0.5 to 20%.

III. Procedure

The sand and coloring agents were weighed out in percentage weights and one hundred-gram batches were used. A thorough mixture of each was obtained by grinding the ingredients with a glass pestle and further mixing was done by hand. In the case of the soluble salts, the coloring agents were first dissolved in distilled water and poured over the sand. The mixture was then left to dry before using. The clay was tempered, by hand, to a soft mud consistency with 28% water. A wooden mold, $^3/_8$ by $1^1/_2$ by 12 inches, with a removable bottom was used. The inside of the mold was moistened with a wet sponge and the sand was sprinkled into the mold. All the sand which would not stick to the wet mold was bumped off. The clay was then forced into the mold and the excess was struck off. The clay bar was then cut into test pieces two inches long. These pieces were placed on paper and on wooden pallets and allowed to dry. The test pieces were placed in saggers and fired in a downdraft test kiln under oxidizing conditions. The pieces were fired to four temperatures, cones 03, 01, 1, and 3. In each case the kiln was fired to the desired temperature in twenty-two hours.

[1] H. Ries, *New York State Museum Bull.*, No. 35, p. 687 (1900).

IV. Results

(1) Physical Condition of the Sand

In most cases at cone 03 there was not sufficient fluxing action in the coloring agents to make the sand adhere tightly to the clay. At cone 01 this condition was somewhat improved, but in most cases it was necessary to fire to cone 1 or higher to have the sand sufficiently tight so that it could not be rubbed off.

(2) Color Effects

In practically all cases, 0.5% and 1% of the coloring agent produced no change in color from the unstained sand.

(*a*) *Copperas (Ferrous Sulfate):* At cones 03 and 01, the effects were the same for the equal amounts of the stain. From 3%, the color increased to darker pink with the increase in the amount of copperas. At cone 1 the best results were obtained; a deep red resulted, increasing in darkness with the increase in the amounts of the coloring agent. The red color, however, was not solid but appeared in patches producing a pleasing effect.

(*b*) *Ferric Chloride:* With 0.5% and 1%, there was no change in color from the natural sand. The intensity of color increased from a light red to a darker red with the increased amounts of stain. This is a brighter red than was obtained with any of the other compounds except with copperas.

(*c*) *Manganese Chloride:* At cones 03 and 01, the colors were the same for the same amounts of stain, increasing slightly to dark brown with 20%. At cones 1 and 2, the colors were the same for the same amounts of coloring agent increasing in intensity to dark grayish brown with 20%.

(*d*) *Hematite:* From 2 to 20% stain, the color

increased in intensity from a light maroon to a dark maroon. There was little change in color at the different temperatures.

(*e*) *Red Oxide A:* From 2 to 20% stain, the color was a slightly lighter maroon than that obtained with the same amounts of hematite; otherwise the results were the same.

(*f*) *Commercial Venetian Red:* At cone 03, the intensity of the color increased from a light tan to a trifle darker tan with the increase in amounts of the stain from 1 to 10%. The color intensity increased to a darker tan with increase in temperature.

(*g*) *Manganese Dioxide:* 1% stain gave a light brown color and the intensity of color increased in darkness to a jet black with 20%. The colors were practically the same at all temperatures.

(*h*) *Black Flash:* The various percentages of black flash produced a slightly lighter color than the same amounts of manganese dioxide. This was true at all temperatures.

(*i*) *Chrome Oxide:* The intensity of color increased from a dark reddish brown with 1% stain to a grayish black with 15%. The colors for the corresponding amounts of stain were the same for all temperatures.

(*j*) *Iron Chromate:* The color with 1% stain was a light reddish brown, increasing in intensity to a dark reddish brown with 10% stain. The colors for the corresponding amounts of stain were the same for all temperatures.

(*k*) *Black Iron Oxide:* At cone 03, the color intensity increased from a light reddish tan with 1% stain to a dark reddish tan at 15%. At cone 01, the colors were a trifle darker than at cone 03. At cone 1, the intensity of color increased from a dark reddish brown with 1% to a light purplish black with 15% stain. At cone 3, the colors were a little darker than at cone 1.

(*l*) *Powdered Blue:* At cones 03 and 01, the colors were the same for the corresponding amounts of coloring agent increasing in intensity from a light brownish gray with 1% stain to a dark greenish gray with 10%. At cones 1 and 3, the colors were darker, increasing to a dark grayish brown with 10% stain.

(*m*) *Limonite:* There was little change in color with the increasing amounts of stain. The intensity in red color became slightly darker with the increased amounts of limonite. There was also a change to a darker red at the higher temperatures.

(*n*) *Magnetite:* The results were the same as with limonite.

(*o*) *Burnt Umber:* The increased amounts of stain gave an increase in the intensity of color from a light reddish brown with 1% to a dark grayish brown with 10%. The colors became a little darker at the higher temperatures.

(*p*) *Whiting:* From 3% stain, the color became gradually lighter to a grayish buff with 25%; the intensity of color became lighter with increase in temperature.

(*q*) *Hydrated Lime:* As a stain, hydrated lime gave much the same results as whiting, except that it was more powerful in staining property; 15% hydrated lime was a much lighter grayish buff than 25% whiting. The color intensity lightened with increased temperature.

(*r*) *Monmouth Clay (Buff-Firing):* At cone 03, there was little change in color, with increased amounts from 2 to 15% producing a white scum appearance. At cone 01 the color changed a trifle to a very light brown.

(*s*) *Yellow Ochre:* The color was almost the same up to 10% stain; the 10% stain produced a light brown, increasing in intensity to a darker brown at 20%. The colors were the same at cones 03 and 01. At the higher temperatures (cones 1 and 3), the color changed from a light reddish brown with 1% to a dark reddish brown at 20%.

V. Discussion

Some of the coloring agents gave little increase in intensity of color with increase in temperature, some gave little increase in intensity of color with increased amounts of stain for the same temperature, while others gave an increase in intensity of color with increased amounts of stain and increase in temperature.

(1) In the first group are hematite, manganese dioxide, red oxide A, limonite, magnetite, and black flash.

(2) In the second group are chrome oxide, iron chromate, commercial Venetian red, yellow ochre, and manganese chloride.

(3) In the third group are burnt umber, whiting, copperas, iron chloride, black iron oxide, and powdered blue.

VI. Conclusion

The most desirable red colors were obtained by the use of the soluble salts, copperas (ferrous sulfate), and ferric chloride. The red colors pro-

duced with these stains were brighter and had more life than the colors produced with hematite. Good warm brown colors were obtained with black iron oxide, while the best blacks were obtained by the use of manganese dioxide. A whitewash appearance was produced by whiting and hydrated lime, the lime being the most powerful stain.

By blending the red colors produced with copperas and ferric chloride with the browns of black iron oxide and blacks obtained with manganese dioxide, a pleasing range of color results.

These colors were all produced by firing under oxidizing conditions and, because of this, the same colors can be duplicated in scove kilns.

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COLLOIDAL GRAPHITE AND ITS RÔLE IN THE CERAMIC INDUSTRY*

By Raymond Szymanowitz and Bernard H. Porter

Abstract

In tracing the development of colloidal graphite from the early work of E. G. Acheson on the plasticity of clays to the present use of graphited lubricants in the ceramic industry, the authors have mentioned historical data of general interest, described the physical properties of colloidal graphite suspensions, related these characteristics to glassworking techniques, and cited practical tests showing the advantages to be accrued from this type of adjunct lubricant.

I. Introduction

The subject of colloidal graphite is one which should be of double interest to ceramists, not alone for the reason that its peculiar properties make it a valuable tool in the industry, but because its inception was the result of what may be looked upon as classical studies involving the plasticity of clays.

II. Historical

To do justice to the subject of colloidal graphite, one must give some details surrounding the activities of its originator, Edward Goodrich Acheson, during the decade prior to the advent of this unique material.

After his discovery of "Carborundum" (silicon carbide), Acheson sought to improve this unusual abrasive by subjecting it to higher temperatures for longer periods of time. Instead of obtaining a harder material, however, he brought about the decomposition of the "Carborundum," the silicon volatilizing and leaving as a residue pure graphitic graphite, one of the softest solids known to man. This simple experiment gave birth to a new industry, that of producing manufactured or, as it is better known, Acheson graphite. It is quite common to hear man-made graphite spoken of as "artificial." It should be understood, though, that Acheson graphite is artificial in the same sense that manufactured ice is artificial. Both the ice and graphite are none the less genuine because of man's handiwork. In fact, either of these materials possesses a greater degree of purity than corresponding products yielded by "Mother Nature."

After Acheson had succeeded in producing graphite on a commercial scale, he sought to find some uses for it. At the time, about 1901, the crucible trade was the largest consumer of graphite, with the result that a rather lengthy research project was started by Acheson to adapt electric-furnace graphite for this purpose. In experimenting with binders, Acheson found that German clays were far superior to those of American origin because of their greater plasticity and higher tensile strength. After chemical analyses showed that domestic and foreign clays were practically alike, Acheson's scientific inquisitiveness was aroused to such a degree that he was determined to find the cause for the vast difference in physical properties.

He was a stranger to the clayworking art which, in this case, proved to be a decided advantage. He was not blinded or swayed by the failures of others. After reading much about residual and sedimentary clays and noting that, as a rule, the latter were satisfactory from the standpoint of

* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 23, 1937 (Materials and Equipment Division). Received February 17, 1937.

plasticity, he concluded that some effect took place during the act of transferring these earths from the point of formation to the place where they were ultimately deposited. It occurred to Acheson that possibly washings of vegetation present in the water were responsible for the physical changes he was eager to duplicate.

Carrying on a series of tests embodying the suspension of kaolin in aqueous solutions containing acetic acid, phenol, creosote, and gallo-tannic acid, Acheson found that the first three compounds produced no effect upon the physical properties of the clay, while the fourth reduced the amount of water necessary to produce the desired fluidity. With this evidence of partial success, he entered upon a program of systematic experiments, the object of which was to find a way of treating domestic clays so that they would equal in quality the imported varieties.

After examining hundreds of animal and vegetable products, Acheson eventually discovered that the working of clay with water containing vegetable compounds like tannin, catechu, and extracts of straw,was most effective in bringing about the desired changes. It was found that when clay was pugged in the presence of these compounds it was possible to produce a plastic mass for molding with a minimum amount of water and that the dried clay was much harder and of a greater tensile strength than material which had not undergone this treatment.

The effect which vegetable matter exerted upon clay was amazing. Curious to know whether anyone had observed this phenomenon, Acheson perused the literature dealing with the history of clayworking in an attempt to find some record of the addition of vegetable or other organic matter to clay. An extensive search revealed but one case of this kind—the biblical story dealing with the brickmaking operations of the Egyptians, as contained in the fifth chapter of Exodus. In commenting on this point, Acheson said,

"The accepted theory of using the straw fibre as a binding agent for the clay had never appealed to me and it now seemed likely that those ancient people were familiar with the effect I had discovered. I procured some oat straw, boiled it in water, decanted the resultant reddish brown liquid, and mixed it with clay. The result was like that produced with gallo-tannic acid, and equal to the best I had obtained. This explained why the straw was used, and why the Children of Israel were successful in substituting stubble for straw, a course that would hardly be possible were the fibre of the straw depended upon as a bond for the clay, but quite feasible where the extract of the plant was used."

In view of this reasoning, Acheson felt that "Egyptianized clay" would be an appropriate name for straw-treated earths.[1]

The results obtained by Acheson were later confirmed by H. Ries,[2] whom he retained for the purpose of carrying on a similar but independent line of research.

In an attempt to explain the action of certain organic compounds on clay bodies, it was discovered that they exerted a "deflocculating" effect upon them, reducing their particle size to dimensions within the colloidal realm. Possessing a huge surface for their mass, the clays which had undergone the "Egyptianizing process" formed viscous suspensions with a minimum amount of water. The close packing made possible by the minute size of the particles explained the hardness and increased tensile strength of objects formed from this material.

The shrinkage of articles made with "Egyptianized clay" was greater than the clay industry would tolerate, and cracking in many instances could not be overcome, with the result that the process never gained wide adoption.

In 1906, Acheson was still at work endeavoring to find new uses for his graphite. Knowing that graphited greases possessed certain advantages over plain greases, he felt that a similar beneficial effect would be had in the case of oil lubrication if liquid petroleum bodies could be made to carry graphite in suspension. Remembering his work with clay, Acheson proceeded to treat powdered graphite with certain vegetable extracts, particularly tannic acid, and ultimately succeeded in producing upon graphite the same effect he had produced upon clay.

Graphite, so treated, while originally termed "deflocculated," was found to be truly colloidal. Within a short time Acheson erected a commercial plant and was in a position to give industry a purer form of graphite in a finer state of subdivision than it was hitherto thought possible to produce.

III. Material in the Colloidal State

Material that has been colloidalized is in a state of suspension. While the particles are extremely

[1] E. G. Acheson, "Egyptianized Clay," *Trans. Amer. Ceram. Soc.*, **6**, 31–46 (discussion, pp. 47–64) (1904).

[2] Professor of Economic Geology at Cornell University.

finely divided, they are not so fine, of course, as the particles of substances in true solution. Usually colloids are spoken of as being in the twilight zone between solution and coarse suspension.

Colloids may be divided into two large classes: (1) those that are lyophillic, or possess an affinity for their carrier, and (2) the lyophobic, which literally fear their carrier. Albumen, gelatin, glue, etc., are typical examples of lyophillic colloids; while silver, gold, copper, graphite, etc., typify the latter class. Materials in the colloidal state take on an electrical charge, exhibit Brownian movement, defy the law of gravity, and are capable of remaining with their carrier under nearly all conditions except evaporation, distillation, and ultra-filtration. A colloid of the lyophillic class is said to be reversible, that is, when freed of its carrier it again assumes the colloidal form when returned to the liquid from which it was removed. Lyophobic colloids, on the other hand, are of the nonreversible variety and when freed of their carrier can not be put back in suspension unless re-processed. Furthermore, lyophobic colloids, in order to be rendered stable, are usually "protected" with a lyophillic colloid. Technically, a body of this kind is known as a "protective colloid." Inasmuch as colloidal particles possess electrical charges, they are acted upon in an electrostatic field and can even be deposited electrolytically alone or with other materials that are either in a colloidal or ionized state. Fink and Prince,[3] for example, have successfully co-deposited colloidal graphite and ionized copper in the experimental production of low-friction bearings.

IV. Properties of Colloidal Graphite

Acheson graphite, which has a specific gravity ranging from 2.0 to 2.5, is stable in inert atmospheres at temperatures up to approximately 3000°C. It does not oxidize under 600°C and then slowly, unless pure oxygen is employed. It is insoluble in acids and alkalis, possesses a low coefficient of expansion, is photoelectrically poor, radio-inactive, strongly resistant to electron bombardment, has a high black-body factor, is remarkably opaque, and under certain conditions is capable of absorbing appreciable quantities of gas. Being quite inert chemically, it is capable of forming protective coatings on solids to discourage corrosion, has a greater affinity for oil than is the case with metal, and, what is probably its most important property, graphite is highly unctuous.

Debye and Scherrer,[4] in the course of their X-ray diffraction experiments, revealed that graphite has a structure as shown in Fig. 1. The

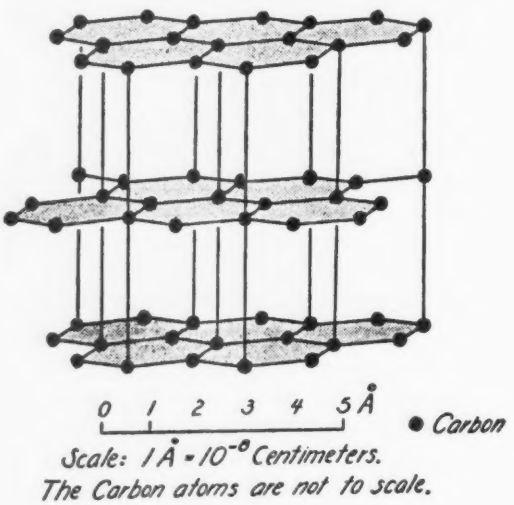

FIG. 1.

atoms in the shaded layers are in the corner of hexagons and are very close to each other, being bound together to form a strong layer. The layers of these hexagons, however, are separated by more than $2^1/_2$ times the length of the hexagon side, with the result that the layers are loosely bound together. This structure gives the easy shear parallel to the plane of the hexagons. The diamond, on the other hand, has all its atoms packed together closely at a distance approximately equal to the hexagon side in the graphite structure, giving it great strength in all directions.

Being of the lyophobic or nonreversible type, colloidal graphite is sold dispersed in liquids only. Its carriers should be free of electrolytes as the presence of ions tends to neutralize the electric charge on the particles and thus destroys their colloidal properties. Colloidal graphite is available dispersed in water, mineral oil, castor oil, glycerin, and phenolformaldehyde varnish. It is usually marketed in a high degree of concentration, having a solids content of from 10 to 22%. These commercial forms are well adapted for

[3] C. G. Fink and J. D. Prince, "The Co-Deposition of Copper and Graphite," *Trans. Amer. Electrochem. Soc.*, **54**, 315–23 (1928).

[4] P. Debye and P. Scherrer, "X-Ray Interference from Orientated Particles: III," (Interferenzen au Regellos Orientierten Teilchen im Röntgenlicht: III), *Phys. Z.*, **18**, 291–302 (1917).

dilution with miscible, electrolyte-free liquids. The two dispersions which are likely to be of especial interest to ceramists are those in water and mineral oil.

The concentrated aqueous suspension is particularly useful in the arts. When applied to solids, colloidal-graphited water forms, upon evaporation of its carrier, tenacious, homogeneous graphite films which possess all of the properties of pure electric-furnace graphite. These films find a multitude of uses in industry. While many of these applications are of no interest to ceramists, it may be well to record a few to illustrate the versatility of a product of this character. For example, graphite dispersions are employed as a die lubricant for drawing tungsten and molybdenum; as a resistance element in radio volume controls and the like; as a ray-focusing anode in cathode-ray tubes employed in television reception; as a preventative of secondary and undesirable primary emission in radio tubes; as a parting compound in casting operations; for reducing contact resistance in electrolytic rectifiers; for the impregnation of porous solids; and various applications in the ceramic industry which will be taken up later.

While the aqueous suspensions and the films formed therefrom are excellent special-purpose lubricants, it will be observed that many of the applications make use of some property of the graphite other than its lubricity. Colloidal dispersions of graphite in mineral oil, however, are employed primarily for lubrication purposes.

When a lubricating oil containing colloidal graphite to the extent of 0.1 to 0.2% is used consistently in a mechanical device, it forms on the friction surfaces an ultra-thin layer of adsorbed graphite which is usually spoken of as a "graphoid surface." Graphoid surfaces, while usually invisible, have been definitely proved to exist by microchemical analysis, by the electron-diffraction camera, and by the reduction in wear which accompanies the use of a colloidal graphite lubricant.

Adsorbed graphite, while retaining its ability to lubricate, possesses one of the fundamental properties of an efficient lubricant, the ability to saturate the surface forces of bearings, shafts, guides, etc. Hardy[5] is the authority for the statement that "the function of a lubricant is to reduce the energy of the surface and thereby to reduce the capacity for cohesion and the resistance to slip when two composite surfaces are applied the one to the other." He further states[6] that the friction of two clean surfaces is due not to the surfaces but to the adhesion between them. A film of oxide or sulfide on a surface of copper, for example, acts as an effective lubricant owing to the lowering of the surface energy of the copper. Hardy[7] concludes that the adsorption of the lubricant by the solid appears to be a controlling factor. The better lubricant is the one more adsorbed by the solid.

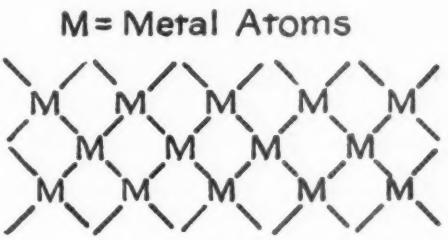

FIG. 2.

Upon referring to Fig. 2, it will be noted that the metal atoms which are not on the surface exhibit an affinity for each of their neighboring atoms through what might be called secondary valence bonds. The surface atoms, however, are rich in unsatisfied bonds responsible for the surface energies to which Hardy makes reference. Just as oxygen satisfies the surface energy in the case of Hardy's polished copper strip, so does adsorbed graphite saturate the surface forces of the friction parts to which it becomes affixed.

A graphoid surface has another outstanding property, that of having a lower interfacial tension with oil than do metals. Plenty of evidence exists that there are different degrees of wetting and that the surface most easily wetted is the one most difficult to wipe dry. Hence, from a practical standpoint, graphoid surfaces reduce the tendency of oil films to rupture.

Because of the physical structure of graphite (see Fig. 1) and its resistance to oxidation, it is common to employ this material in high-temperature applications where oil is subject to destruction either by distillation or decomposition. In these instances, it is customary to mix the concentrated graphite dispersion with a low-viscosity oil

[5] W. B. Hardy and J. K. Hardy, "Note on Static Friction and on Lubricating Properties of Certain Chemical Substances," *Phil. Mag.*, [6] **38** [223] 32–49 (1919).

[6] W. B. Hardy, "Problems of Lubrication," *Proc. Roy. Inst. Great Britain*, **23** [114] 65–72 (1920).

[7] W. B. Hardy, "Static Friction: II," *Phil. Mag.*, [6] **40** [236] 201–210 (1920).

that distills off readily without undue decomposition, to leave a residue of pure graphite.

V. Glass-Drawing Machines

Tests[8] made abroad substantiate the above characteristics and relate them directly to the glass industry. A 10% dispersion by weight of colloidal graphite in mineral oil is used on the "Brevet Fourcauld" glass-drawing machines of the vertical type, having 28 rollers each and at least 8 machines constituting the minimum installation.

The lubricating facilities consist, mainly, of grease cups on the bearings of the rollers, there being two grease lubricators for each roller, hence 56 per machine and 448 per installation. The difficulties with lubrication arise principally when the bearings of the rollers come into close contact with the molten glass. The temperature prevailing is estimated at 840° to 880°F, at which point lubrication is practically impossible as the oil used burns immediately to hard carbon.

Various systems of lubrication, dependent upon the ingenuity of glass engineers, have been applied in the course of years. In some plants no lubrication whatsoever is applied, in which case they have simply allowed somewhat more space between the journals and the bearings. Some plants use a mixture of flaked graphite and petroleum. Others spread oil for half an hour and, afterward, for another half hour use a second petroleum to dissolve the previous crust of oil formed. The consequence of these methods, however, is that after a short time the rollers become jammed, making it necessary to disassemble the machine and refinish the journals as well as the bearings. This results in loss of production and high expenditure for repairs. Moreover, two workmen are required at each plant to look after the lubrication of the machines.

To overcome these difficulties, the journals are treated with a concentrated graphite dispersion at the time of assembling the machine. Afterward, during operation, the machine is lubricated with 0.4% by weight of colloidal graphite to each gallon of mineral oil, the latter having a viscosity of 250 seconds Redwood at 120°F.

With such lubrication it has proved possible to allow the machines to run for four months without overhaul. Previous to the use of colloidal graphite this had to be effected every three to four weeks. It is interesting to note that overhauls now consist only of cleaning any carbon deposit out of the oil grooves instead of a complete overhaul and refinishing of the bearings. Furthermore, the entire machine runs more silently and the amount of electric current used is less than before.

[8] Private communication.

VI. Glass Molding

The lubrication problems connected with glass forming in metal molds present complications as the process requires the operation of mechanisms near a furnace and the heated product. In this application, most high-viscosity oils decompose readily. Similarly, the petroleum body of those greases thickened with adjunct compounds is consumed at high temperatures, leaving a residue of nonlubricating soap. Any such lubrication is inadequate as "washboards" result; that is to say, if the blank mold lacks an inert coating, the glass tends to stick to the sides and to move very slowly with jerks. The glass becomes sluggish rapidly so that these corrugations or "washboards" can never be entirely removed, thus causing the piece to be scrapped, the blanks to be removed for cleansing, and production to be held up. In addition, many mineral oils tend to soil the mold and to give the glass product a rough appearance. Glass also has a natural tendency to adhere to any metallic mold surface.

When breaking in new molds, the usual tendency is to lubricate excessively, the process not only soiling them but spreading the lubricant on other parts of the machine. Any later cleansing action, usually performed with emery cloth, alters the angles and surfaces of the mold.

During the production of glass bottles and similar objects, the operator contends not only with rapid decomposition of plain oils by reason of the high mold temperatures, but also with the adhesion of the falling gob to the parison molds. In the case of the blow mold, the friction factor is eliminated, but there is sticking of the molten glass about the shoulders of the bottle. It is also said that, after the usual application of the "sulfur and graphite stick" in such cases, the sulfur burns away, leaving an excessive graphite deposit that stains the bottles. Apart from such losses in production, the above "sticks" also form a film that may promote mold corrosion.

Comparative tests on oils applicable for the above lubrication difficulties in the glass industry indicate, however, that colloidal-graphited dis-

persions can serve efficiently both as high-temperature lubricants and as parting compounds. For the case of glass-molding machines not unlike the "Owens" and "O'Neill" types, it has been found that the addition of 0.2% by weight of colloidal graphite to each gallon of the plain oil as ordinarily used yields much improved results. Tests made on a number of "O'Neill" machine molds showed that after wiping off the old carbon the molds had a highly polished surface and that this polish could be maintained by using much less of the graphited lubricant. Thus economy is combined with improved results. In this connection, it has been reported that "as a result of graphited oil application to the parison molds, which are working continually at a comparatively high temperature, we find that a perfectly smooth graphoid skin is deposited on the surfaces, which considerably aids the flow of the glass. Also, at a later blowing stage, by reason of this graphoid film, the glass is prevented from coming into actual contact with the cast-iron molds, thus reducing the tendency to 'stick' or 'drag' when they are opened to deliver the finished bottle."

Most bottle machines are equipped with automatic air-oil sprays that can be adjusted for the proper lubrication, or simple hand-swabbing methods are used. Usually the molds are cleansed with a solution of alcoholic soda. The sound of the falling glass on entering the molds roughly indicates when lubrication is required. Whenever possible, the deposited film should be polished with a soft cloth.

VII. Further Applications

The efficiency of graphited lubricants for high-temperature work is shown by its wide use in industry. Baking and enameling oven chains, furnace and kiln-car bearings, and similar devices use a graphited lubricant where an ordinary oil would soon be consumed.

The moving parts of automatic glass-molding equipment, as, for example, snips, neck rings, hinges, and fringe pins can also be lubricated to advantage with colloidal graphite. In some instances, it is advisable to use water-white kerosene to convey the graphite to those points of application where the fluid later evaporates to leave graphite serving as a dry lubricant.

Screw pegs used for threading glass insulators of the telephone and telegraph type are lubricated with colloidal graphite in oil or water and applied with a brush or an automatic atomizer. The graphite, being of colloidal dimensions, will not clog the finest spray gun or atomizer.

Incandescent lamp and vacuum-tube machines, particularly stem machines, have a tendency to stick owing to the failure of the lubricant on those parts near the blow torches. A graphoid surface such as is produced by lubricants containing 2% colloidal graphite reduces this trouble to a minimum.

VIII. Glassworking Tools

Metallic tools, similar to turn-pins, pincers, and cones, as designed for flaring tumblers and forming lips, necks, stems, and tips on a variety of receptacles, are more efficiently used when aqueous dispersions of colloidal graphite serve as a parting compound thereon.

While the affinity between metals and glass in a semiplastic state may also be overcome by utilizing organic compounds like mutton tallow and beeswax, experience indicates that such materials tend to decompose readily in the presence of high temperatures. In addition to producing an acrid smoke and being somewhat difficult to use, such compounds frequently impart objectionable stains to the objects being formed.

Graphite films, however, when produced by plunging or dipping the heated tool into a bath of dilute colloidal graphite in water, possess the combined features of being tenacious, unctuous, and highly resistant to oxidation. Moreover, since colloidalized graphite materials are chemically inert, no decomposition products are formed, with the result that stain-free articles are obtained without attendant smoking.

The colloidal graphite content of plunging baths may be varied to meet individual requirements. During the course of the tool treatments, the water content is consumed by evaporation, thus making necessary the further addition of "make-up" water from time to time. The proper interval in which to replenish the bath with colloidal graphite is determined by experience.

By immersing the tool in the aqueous bath but momentarily, it retains sufficient heat to dry completely the graphite film upon its withdrawal. The frequency of such manipulation depends upon the extent of the shaping of the mass of glass being worked.

The above manner of application is particularly applicable to the manufacture of surgical glass-

ware, as, for example, the shaping of the plungers and the tips of hypodermic syringes.

IX. Hand-Blown Ware

Aqueous suspensions of colloidal graphite produce a film which, when dry, is an ideal solid lubricant or parting compound for use on blow-molds employed in the manufacture of hand-blown articles. While application of this product may be made directly to a cold mold, the efficiency of the operation and the quality of the resulting ware is appreciably benefited when the mold is partially heated. After the surfaces have thoroughly dried they are buffed to a high polish with a soft cloth to produce the entirely smooth and wholly unctuous areas that tend to eliminate temporary sticking whenever the mold is rotated at the time of blowing. A veneer of graphite obtained with colloidal graphite in water overcomes metal-glass affinity and avoids streaks or "washboards" on the finished object.

It has been the purpose of the writers to point out the characteristics of colloidal graphite and to suggest some of its applications in the ceramic industry. With the continued development in this field, there is every reason to suppose that colloidal-graphited lubricants will be found increasingly useful.

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PENNSYLVANIA GLASS SAND INDUSTRY IN 1936*

By R. W. Stone

I. History

The Pennsylvania glass sand industry that produces annually a raw material worth about three-quarter million dollars, began about 137 years ago through the hospitality of a man on horseback. According to the story, when Albert Gallatin, former Secretary of the United States Treasury and founder of the town of New Geneva on the bank of the Monongahela River in Fayette County, was on his way to Washington, D. C., he met a party of eight men from Alsace-Lorraine, calling themselves Germans. They were glass blowers travelling west. He invited them to stop at his place and, finding sand and limestone there, they settled and for several years made glass, using wood for fuel. Later (1806) they fell out with Gallatin, crossed the Monongahela, and built a small settlement and glassworks about one mile below the present site of Greensboro and only a few miles north of the West Virginia line. I have seen an 8-inch flask of light olive-green glass reputed to have been made there by these Germans. They are said to have used sand found on the river bluff.

From this small beginning, Pennsylvania has become the leading manufacturer of glass in this country. At the last federal census, there were 61 glass plants in the State that reported $5000 or more annual business; West Virginia had 41. Most of these plants are in the western part of the State, particularly in Allegheny and Westmoreland counties. The deposits of highest grade sand are in Huntingdon and Mifflin counties in the south-central part of the State, but the location of the glass plants is influenced by the availability of cheap fuel in the western end of the State. Sand and limestone suitable for making many kinds of glass also occur in that region.

II. Sources of Sand

Silica is the most important constituent entering into the composition of glass. There is no glass in a technical sense that does not have silica as an ingredient. Silicon, next to oxygen, is the most abundant element found in nature. It occurs in combination with oxygen as the oxide, SiO_2, in a variety of forms, of which quartz is most common.

But where shall we find pure quartz in great abundance? There are two principal sources in Pennsylvania, the Oriskany sandstone and the Pottsville formation, particularly its upper member, the Homewood sandstone. Of these two, Oriskany sandstone is the purest and most of the glass sand comes from it.

The Oriskany sandstone extends from central New York, where it was named, to Alabama and

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Georgia. Its character is variable. In some places it is a sandy limestone but at a few places, as Berkeley Springs, W.Va., and Mapleton, Pa., it is a white friable sandstone, easily crushed, and when washed produces a sand exceeding the advertised purity of Ivory soap. No one driving the William Penn Highway between Mount Union and Huntingdon can fail to see the great white quarry face half a mile long and up to 200 feet high that parallels the concrete, and those who travel on the Pennsylvania Railroad between those points will be familiar with it.

The beds in the quarry stand at an angle of 65°, but the sand was laid down on the bottom of a shallow sea and was derived from an ancient land mass, at least part of which was east of the present Atlantic seaboard. Thousands of feet of other sediments deposited in the sea compacted and cemented the loose sand into hard sandstone. The tremendous forces that squeezed the earth's crust into great folds paralleling the Atlantic coast for 1500 miles left the Oriskany sandstone high above sea-level in the central part of Pennsylvania. Most of its outcrops are the truncated edges of upturned beds. Their marine origin is evidenced by the molds and casts of sea shells found in the rock; so it might be said that much of our glass is only melted sea bottom. Did you ever think of it that way? Where the sand grains came from originally and how they were accumulated as clean sea sand is another tale which time does not permit telling here.

The Homewood and other sandstones in the western part of the State that are used for glass sand are flat-lying beds and have been worked in various localities from the New York to the West Virginia line. These sands are only slightly less pure and are used for common window, blue, and amber glass. Most of the production has been from quarries, but glass sand has been mined underground at least in two localities.

III. Quarrying and Washing

In some places the Oriskany sandstone is so soft or deeply weathered that it can be dug by steam shovel with little or no blasting. At others, the rock must be shot down with explosives. In the largest quarry, that of the Pennsylvania Glass Sand Corporation at Mapleton, because the sandrock formation, which is about 125 feet thick, stands at a high angle dipping toward the toe of the quarry and because of the 200-foot face, the method of well drilling as a means of placing explosives is impracticable. According to E. T. Andrews, of the Pennsylvania Glass Sand Corporation, most of the primary blasting is accomplished by the application of the "snake-hole" method.

Two-inch holes are drilled at an angle of 30 degrees with the horizontal, or at about right angles to the face of the rock, at the quarry floor for a depth of approximately 20 feet. These holes are "sprung" by shooting 2, 3, or 4 small successive charges of dynamite which enlarge the bottom of the hole into a pocket capable of receiving 100 to 200 pounds of dynamite.

The shooting of a series of these holes withdraws a wedge and loosens the material above, permitting a large portion of the upper part of the ledge to slide down a natural slip or bedding plane.

Primary blasting is also accomplished at infrequent instances at strategic points by the use of the "coyote hole," or tunnel method. A 4- by 5-foot tunnel is driven directly into the face of the ledge at quarry level, for distances varying from 75 to 100 feet. At its extreme end, drifts are driven approximately parallel to the rock face. Small rooms are driven at right angles to the drifts to permit the location of dynamite charges at predetermined points. Charges of considerable magnitude are required in this method of blasting and are fired simultaneously by the use of Cordeau-Bickford fuse and electric detonators.

Secondary shooting consists primarily of breaking down by "block-holing" such pieces of rock as are too large for the shovels or crushing equipment to handle. A $1^1/_4$-inch hole is drilled to a point near the center of the piece, in which a charge of dynamite, sufficient to break the rock into several smaller units, is inserted, tamped, and fired.

Automobile trucks loaded by power shovel deliver the broken rock to a grizzly or inclined screen made of steel rails set two inches apart. Material falling through the grizzly goes direct to a belt conveyer and the oversize to a crusher and thence to the conveyer which delivers the lumps and sand to chaser mills or grinding pans. These consist of a heavy steel pan, 9 feet in diameter, in which revolve two large steel rolls mounted on a horizontal axis. Water is fed into the pan and when the material is reduced to proper

size it escapes through screens at the sides of the pan. The rolls usually have a 12-inch face and each weighs $2^1/_2$ to 3 tons.

From the chaser mill, the sand goes to a 3- by 5-foot electric vibrating screen in the most modern plants; in others, to a revolving screen 7 to 8 feet in diameter and 2 to 3 feet wide, a large upright wheel rimmed with brass wire mesh having 10 to 12 openings per linear inch. The undersize material passes through the screen to the washer and the oversize is returned to the chaser mill.

The sand washer is a simple but clever machine, not unlike a carpenter's auger revolving in a tilted box built to fit the bit. A sand washer is a series of inclined troughs or boxes, each 12 feet long, about 20 inches square, in which revolves a wide-flanged screw, 20 inches in diameter, made of rolled abrasive-resistant metal. Sand is fed to the lower end and conveyed up the box by the screw against a stream of water fed at the upper end. For complete cleaning, the sand goes through three or four washers in succession. Washing is for the purpose of removing vegetal matter and clayey material and to reduce the alumina and ferric oxide content. Any clay that gets by the grinding and washing action of the chaser mill and screen has a strong affinity for its particular sand grain, if it can cling all the way through the first washer. The second washer routs out "the tough guys," and the third or fourth washer delivers clean sand to a rubber-belt conveyer which carries the sand direct to railroad cars if it is to be shipped wet and to a draining shed if the sand is to be dried.

The inside of a full draining shed is a pretty sight. Wet sand is distributed from a belt under the roof. It is built up in cones which have their tips just under the belt. The surface, of course, drains quickly, and the snow-white mounds of pure silica sand suggest even to an oldster the idea of a jump and a slide. When the sand has drained a half day it is ready for the drier. Experience with various kinds, including a rotary cylinder with baffles, has shown that the best, now commonly used, is the steam drier. Parallel brick walls are built about 6 feet apart and 20 feet long, with the inner side built out to form a hopper bottom. Between these walls, horizontal banks of steam pipes are arranged in tiers on angle irons. The spacing of the pipes decreases from top to bottom. Sand is distributed on them from an overhead belt conveyer and the dry sand falls through the hopper bottom onto a similar belt, which carries it to screens that vary in different plants from 14- to 22-mesh per linear inch. The screeened sand then goes to storage bins, from which it is delivered by chutes to paper-lined box cars for shipment. Such an operation on a high-grade rock, by the process described, can produce a sand with less than 0.02% impurity.

IV. Underground Mining

Glass sand has been mined underground near Lewistown by a quarter-mile tunnel and drifts a half mile long on two or more levels. About one-half of the deposit was mined out by large rooms. The rock was so soft and crumbly that much timber was required to support the walls. Glass sand was mined years ago at West Winfield in Butler County in nearly flat-lying beds by much the same method as limestone is mined in that region.

As far as the writer knows, the only place where glass sand is now being mined, instead of quarried in open pits, is at Dunbar in Fayette County. The Dunbar Corporation operated two quarries in the Pottsville sandstone until 1930 when a main entry was driven in the face of the quarry. This entry now extends underground about 500 feet and is 45 feet wide and 45 feet high. A second parallel entry is not so long. Cross-headings are driven 40 feet wide on 100-foot centers. Pneumatic drills are used and the rock is shot down and loaded by an electric caterpillar shovel into automobile trucks which, because of the size of the entry, can be driven in to the working faces.

V. Business Barometer

Last year (1936) six or eight operations were producing glass sand. The industry is a fair business barometer. When times are hard, construction slumps and the demand for window glass and plate glass falls off. The demand for automobile glass decreases somewhat and that for glass fruit jars may increase, if the depression is sufficiently prolonged to induce increased home canning. When business picks up, it is reflected at once in an increased demand for glass sand. The output in 1936 presumably increased considerably over that of 1935, the latest year for which figures are available, and it is possible that in 1937 the yield will be greater than in any pre-

vious year. Pennsylvania glass-sand resources are extensive and the industry should be long-lived.

VI. Quantity and Quality

Illinois ranks first in the quantity of glass sand marketed. Pennsylvania and West Virginia are rivals for second place. In three recent years (1932 to 1934), West Virginia produced 1,088,000 tons and Pennsylvania 1,061,000 tons, a difference of only 27,000 tons in West Virginia's favor. Illinois' lead in those three years was less than 100,000 tons. This lead is in tonnage, not in value, for in four years the value of Illinois glass sand sold was $1^3/_4$ million dollars as against $2,635,000 for Pennsylvania's output. The average price of Illinois glass sand is about $1.00 to $1.18 per ton and that of Pennsylvania sand from $1.70 to $2.00.

As for quality, the Homewood sand produced by the Dunbar Corporation for amber glass carries 99.35% silica and 0.25% iron oxide, and the Oriskany sand of the Pennsylvania Glass Sand Corporation is 99.82% silica and 0.014% iron oxide. Some analyses by this Company have shown 99.99% silica. The iron oxide content of Pennsylvania's highest grade dry glass sand, 0.014%, is very low in comparison with the 0.09 to 0.5% in white St. Peters sandstone from Illinois.

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CLAY REFINING BY FLOTATION METHODS*

By M. C. Shaw

Abstract

Flotation is a phenomenon of wetting, which is a variable property of minerals. Nonwettable minerals are usually good floaters; minerals easily wetted are not. It was found that the froth flotation method, by which air or gas is added to air flotation, is not practical for clay flotation. Film or oil flotation, using fuel oil, wood creosote, or turpentine, gave encouraging results.

I. Introduction

Up to the time of the present writing there has never been, to the knowledge of the author, any attempt to apply commercially the unlimited possibilities of flotation as referred to by the ore-dressing engineer to the problem of clay refining. In view of the fact that flotation was proved through this investigation to have great possibilities as a clay refining method and since there is no information published in the ceramic literature covering the principles of flotation, some of the fundamentals involved will be discussed.

II. Flotation Concentration

Perhaps the most important factor involved in flotation work is the phenomenon of wetting. Wetting, as the term is applied here, refers to the spread of a liquid over the surface of a solid with the subsequent displacement of another liquid or gas. For instance, clean glass is readily wetted by water; that is, water readily displaces any air film which may be on the glass and spreads out over the surface. When mercury is placed on glass, however, there is no wetting; the mercury tends to draw up into a globule rather than to flatten out over the surface.

Wetting is a variable property, depending upon the surface properties of the various solid, liquid, and gaseous phases under consideration. It is generally considered that the ability of a mineral to float is directly dependent upon its ability to resist wetting by water; that is, nonwettable minerals are usually good floaters while minerals that are easily wetted are not.

For example, if particles of a metallic sulfide, such as zinc sulfide or iron sulfide, are compared as to their floatability in a water circuit with the gangue of these minerals, the sulfide ore under the proper conditions will float; the gangue will not float but will absorb the water, be wetted, and,

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as a result, sink. The explanation of this condition lies in the fact that the particle of sulfide ore normally has a film of air surrounding it, and when it is placed in water the force of adhesion of the particle for the air film is great enough to prevent the water from displacing this film of air. The surface tension of the water also prevents the particles from breaking through the surface of the water. If, however, instead of the sulfide ore, a particle of its gangue is considered, a different condition is seen. The gangue material while in the air does have a film of air surrounding it, but the force of adhesion of the gangue for the air film is not nearly as great as that of the sulfide ore for the air. As a result, when the gangue is dropped upon the water, owing to the fact that it has a preference for water over air, the air film is displaced by the water and the particles immediately sink. These two examples show the extreme possibilities. The sulfide ore has a greater force of adhesion for air and is said to resist wetting, while the gangue has a feeble force of adhesion for air which permits it to be easily displaced by the water and is thought to be easily wetted.

Some oils, however, unlike water, tend to spread over a sulfide surface and to wet it. This indicates a greater tendency for adhesion to oil than air or water. On the other hand, gangue materials, sand or clay, again prefer water over oil. This preferential adsorption of the oil by the ore further aids in the flotation of the ore.

In most ore-flotation work, an insoluble oil is added to a water suspension of gangue and ore and the entire batch is thoroughly mixed. In this operation, the sulfide minerals contact the oil and become lightly oiled or filmed, the excess oil being removed from the particle surface by agitation. The gangue, however, having a preference for the water over the oil, absorbs the water. Under these conditions the oil-filmed particles float to the surface and are collected, while the gangue remains in the water phase and sinks to the bottom.

While this discussion covers briefly the basic principles involved in flotation concentration, it does not in any way indicate the numerous possibilities of affecting this operation. Among the more widely known and most effective processes in operation during the past and present are (1) the Elmore bulk-oil or oil-lift method, (2) film or skin flotation, (3) gas-bubble lift, and (4) air-froth flotation. The latter method is most widely used today and is known as froth flotation.

III. Froth Flotation

In view of the efficiency of operation and the effectiveness of the flotation method known as froth flotation in concentrating very small quantities of ore of this type, flotation was the first to be studied in this phase of this investigation.

Froth flotation is affected commercially by the introduction of bubbles of air or some other gas to a slurry of ore, gangue, and water to aid in lifting the floatable particles of ore. The bubbles are usually composed of air but occasionally carbon dioxide, hydrogen, or hydrogen sulfide are used. The oil-filmed particles attach themselves to the bubbles which circulate through the slurry and in this way are carried to the surface. This process is particularly effective when highly concentrated ores are being handled. One of the main advantages of this type of flotation is the low consumption of oil, which is usually less than 1% by weight of the ore being necessary to produce high-grade concentrates.

(1) Experimental Work

In adapting this process as a clay refining method, a laboratory model of the commercial "minerals separation subaeration cell" was used. This unit consists of two chambers; an aeration chamber and a chamber for quiescence where the froth which is formed in the first chamber is allowed to rise to the surface. The aeration chamber contains a rotating paddle or blunger which serves a two-fold purpose, (1) of mixing the ore, water, and flotation reagents and (2) the formation of the froth.

The slip used in this work was very thin, containing only 15% solids. This slip was slowly fed into the blunging chamber and the various reagents were added in definite amounts. The reagents used individually were (1) sodium oleate, (2) pine oil, (3) wood creosote, and (4) fuel oil. These were added in varying amounts and the degree of frothing and the ability of the froth to carry the impurities were noted.

While in most cases, it was possible to develop a good froth with fair carrying power, it was never possible to float a froth free of clay. The colloidal nature of the clay encouraged its formation into a froth and as such was carried away

with the impurities. This difficulty was never overcome in any of this work, so the process was not considered to be applicable in its present form.

IV. Film Flotation

To overcome the difficulty experienced in the froth-flotation method, namely, the flotation of the colloidal clay, the film-flotation method was next investigated. The method of film flotation studied here was a close duplication of the MacQuisten process.

MacQuisten developed a process known as film flotation, which requires comparatively little oil to affect the flotation. A thin pulp, which has previously been slightly oiled, is introduced into one end of a horizontally rotating pipe with a spirally corrugated interior. The rotating action causes the oiled sulfide particles to be carried to the oil-film surface where they are retained. The unaffected gangue, although it may also rise to the surface because of the rotating action, sinks back down to the bottom. The spiral corrugation insures the progress of the gangue to the discharge end of the tube. The sulfide-laden film of oil is discharged into a vat and collected in a launder, while the gangue sinks and is discharged from the bottom.

(1) Experimental Work

In adapting this process to this study, a clay slip containing 25% solids was blunged and ground in a ball mill with the various flotation reagents for a definite length of time sufficient to form the film or skin containing the oiled impurities. This film was then separated from the clay slip by decantation.

The various flotation reagents used were (1) fuel oil, (2) wood creosote, (3) turpentine, and (4) a combination of wood creosote and fuel oil. The amount of reagent required to film the surface and collect all of the impurities was found to be very small and dependent upon (1) the covering power of the flotation reagent, (2) the floating power of the reagents, and (3) the percentage of the impurities in the clay.

After considerable experimentation to determine the proper consistency of the slip, the proper oils, and the correct amount to add, the following laboratory procedure was found to be correct. Five pounds of clay were charged into a laboratory pebble mill with water sufficient to produce a slip containing 25% solid material. To this batch was added 24 drops of creosote and 24 drops of kerosene oil. On blunging this batch for one-half hour, it was found possible to raise most, if not all, of the specking impurities. The impurities at the end of the run were present as a thin black scum on the surface of the water.

After the formation of the film, the batch was permitted to remain undisturbed for a period of 15 minutes, during which time the clay settled readily so that at the end of the period of quiescence it was possible to drain off the top water containing the film of impurities.

The results of this particular phase of the investigation were very encouraging. Proper flotation yielded a clay that was clean and when used as an ingredient in a semivitreous whiteware body produced ware having very good color and entirely free of specks.

One of the particular merits of this process lies in its ability to carry out all of the impurities finer than 80-mesh. This particular phase of clay refining has been perhaps the most difficult to deal with. By this method of beneficiation, however, this class of impurity is the most easily eliminated because it is the most easily floated.

Another advantage of this method lies in its apparent economy. Flotation was accomplished here with the cheapest type of flotation reagent, namely, a combination of kerosene oil and wood creosote. When it is considered that in most cases one-half pint of each of these materials in combination will effectively float out all of the specking impurities in one ton of clay, it can be seen that the reagent costs are very low.

None of the flotation reagents used appeared to have any effect upon the workability, color, or dry or fired properties of the treated clay.

V. Conclusions

The film-flotation method was studied here for the first time in connection with clay beneficiation and has, the author believes, a wide field of utilization. The cheapness of the necessary reagents combined with the apparent effectiveness of the operation should attract the attention and serious consideration of the many clay producers who at present are marketing a clay slightly under the high quality standard.

This method should increase the possibilities for the utilization of the many deposits of impure clay located throughout this country. In this investigation, it was shown that if proper re-

fining methods are utilized many of the more plastic fire clays can be well substituted for some ball clays in the whiteware industry. This result in itself should brighten the outlook for clay producers, such as those marketing the Lawrence clay. When this substitution is commercially verified, the cost of one of the whiteware body ingredients will be lowered, for in many cases imported ball clays are used, and such clays are usually rather expensive.

Another industry that should benefit by the adoption of this means of beneficiation is the manufacturer of glasshouse refractories. This industry requires that the tanks in which the highest quality glasses are to be melted shall be iron-free so that the glass will not be discolored. Many clays are physically suitable for this purpose, but their iron content is so high that when glass is melted in tanks prepared from them the glass is shaded or discolored from the iron impurities. The clays studied here were found to be suitable for whiteware production and gave unspecked, ivory ware. Such clays should most certainly be suitable for glasshouse refractories as far as color-imparting impurities are concerned.

While the film-flotation method is not intended to be a cure-all refining process, it does open up another field of clay beneficiation which warrants some consideration from those who have found the other refining methods inadequate.

The Edward Orton, Jr., Ceramic Foundation
Columbus, Ohio

SUMMATION OF WHITEWARE RESEARCH INVESTIGATION CONDUCTED AT THE NEW YORK STATE COLLEGE OF CERAMICS: I-IV*

By Robert M. Campbell

Abstract

This report describes four investigations carried out at the New York State College of Ceramics upon whiteware subjects. The subject matter present is chiefly the work of senior students. This work is incorporated in their thesis reports, credit for which is required for graduation.

Introduction

Much of the investigation work done by seniors at the New York State College of Ceramics upon whiteware problems deserves recognition. Many students have devoted more time than that required for credit. A few of these investigations are reviewed in this paper.

I, Production of a Light Yellow-Green Body Stain for a Cone $10^1/_2$ Vitreous Body

By Robert E. Cooley, Jr.

Based on previous work done upon this problem, it was decided to concentrate upon chrome stains for the production of greens. Uranium was decided upon as the source of yellow, but the use of various oxides and salts of uranium gave no satisfactory results. As will be commented upon later, satisfactory yellows were produced by utilizing a commercial vanadium stain.

The compositions of the green stains are given, together with comments as to their appearance, in amounts of 5% and 10% in the bisque body as well as their appearance under a glaze.

It was noted that ground glass added to the stains gave a much brighter green; all stains were therefore tested further with the addition of 4% ground glass. The results in Table I indicate that the addition of the glass had a definitely beneficial effect.

None of the stains listed in the table produced the desired light green body.

In further trials, a satisfactory bright yellow body was obtained using 10% commercial vanadium body stain.

To procure a light yellow-green body, additions of 1 to 10% cobalt stain were added to the yellow body which contained, as above, 10% vanadium stain. The results showed a range of color from a greenish yellow to a blue-green. The best

* Presented at the Thirty-Ninth Annual Meeting, American Ceramic Society, New York, N. Y., March 24, 1937 (White Wares Division).

TABLE I

EFFECT OF CHROME STAINS IN VITREOUS TILE BODY

	Cr_2O_3 (%)	Co_3O_4 (%)	SiO_2 (%)	Borax (%)	CaF_2 (%)	$CaCO_3$ (%)	ZnO (%)	$CaCl_2$ (%)	Niter (%)	SnO_2 (%)	White lead (%)	Glass (%)	Al_2O_3 (%)	$K_2Cr_2O_7$ (%)	Color biscuit	Color glaze $c/10^1/_2$	Color stain + 4% glass glaze $c/10^1/_2$
A			20		12	20								36	5% light gray 10% dark gray	Light gray Dark gray	Light gray-green
B	18.6		20		33	11			24.7						As above	As above	Light gray-green
C	18.6		20		22	22			24.7						As above	As above	Light gray-green
D	18.6		20		11	33			24.7						As above	As above	Muddy gray
F	25	4	43	8		12	8								5% pale blue 10% light blue	Light blue Blue-green tinge	Bright blue-green
G	27		20			20		33							5% light gray 10% dark gray (deeper than A)	Light gray Light gray-green	Muddy gray
H	36		20		12	20		12							Like A	Light gray Light gray-green	Light gray-green
I	24		26			36					14				Like A	Pale gray-green Medium gray-green	Light gray-green
J	40		25		20	15									5% light gray (10%) dark gray-green	Pale gray-green Dark leaf green	Good dark green
K	37					63				1		4			5% light leaf green 10% dark green	Medium green Dark green (slight yellow tinge)	Good dark green
L	50	10	40												5% light blue-green 10% dark blue-green	Dark green Dark green (slight blue tinge)	Dark blue-green

combination for the most satisfactory light yellow-green had the following composition: 100 parts body, 10 parts vanadium stain, and 3 parts cobalt stain.

The cobalt stain had a composition of Co_3O_4 3.0, ZnO 12.5, china clay 50, and flint 34.5%.

Conclusion

A satisfactory light yellow-green was obtained and a foundation was laid for the development of green shades in this field.

II, Effect of Vitreous Whiteware Grog in a Vitreous Whiteware Body

BY CHARLES E. EVANS

Many have felt that the introduction of vitreous whiteware grog into a vitreous body would have a beneficial effect upon the body to correct shrinkage and warpage. There has been some doubt as to its ultimate effect upon the fired strength and the vitrification.

To a typical vitreous body, 100-mesh grog was added in amounts of 10, 20, 30, and 40%.

The body used had the following composition:

	(%)
English ball clay	10
Old Mine Ky. No. 4 ball clay	8
English china clay	20
Georgia kaolin	10
Buckingham feldspar	26
Sand flint	26
	100

The 100-mesh grog of the same composition as the above body showed the following dry-screen analysis:

(%)	
0.0	on 100-mesh
2.9	on 125-mesh
19.6	on 200-mesh
24.5	on 325-mesh
53.0	through 325-mesh

Draw trials of all bodies, containing the additions of grog, were made at cones 3, 5, 7, 9, 11, and 13. Bars for warpage, shrinkage, and modulus of rupture determinations were fired to cone 11.

Summary

(1) Grog materially strengthens the fired body.

All additions of grog produced bodies stronger than the standard body. The modulus of rupture determinations showed the standard body to have a strength, by this means, of 7200 pounds per square inch, whereas that body containing 10% grog showed a strength of 9000 pounds per square inch. That body containing 40% grog showed a strength of 8000 pounds per square inch. Modulus of rupture tests on the bodies in the dried state indicated no apparent effect upon the strength with the addition of grog.

(2) The addition of grog reduces drying and firing warpage.

(3) At cone 11, the addition of 30 to 40% grog slightly increased the absorption of the body, the difference being less than $^1/_2$ of 1%. There is apparently no difference in absorption between the standard body and those bodies containing up to 20% grog.

Conclusions

The results indicate a distinct advantage with the use of vitreous whiteware grog in a vitreous body in amounts up to 20%. The use of this type of grog provides a means of utilizing broken and other unsalable ware with advantageous plant results.

III, Substitution of Cristobalite for Quartz in a Whiteware Body

By Phillip M. Bennett

An endeavor was made to produce a vitreous body more resistant to thermal shock through the substitution of cristobalite for quartz in a typical vitreous whiteware body.

The bodies used had the following compositions:

	No. 1 (%)	No. 2 (%)
Old Mine Ky. No. 4 ball clay	10	10
English ball clay	10	10
Georgia kaolin	10	10
English china clay	20	20
Buckingham feldspar	20	20
Sand flint	30	
Cristobalite		30
	100	100

The cristobalite used was made in a commercial plant and produced by the process as developed by Cole.[1]

Microscopic examination showed this material to have the following approximate analysis: cristobalite 70%, tridymite 20%, and quartz 10%.

Suitable specimens of each body were fired to cone 11 in twenty hours and test determinations were made on modulus of rupture, apparent porosity, resistance to quenching, and thermal expansion.

Results

(1) Cristobalite reduces the fired strength. The modulus of rupture of body No. 1 was 7900 pounds per square inch; whereas that of body No. 2 was but 4300 pounds per square inch.

(2) At cone 11, the cristobalite body had a porosity 1% higher than the quartz body.

(3) The thermal expansion curves, as developed from data obtained by use of the interferometer, showed the greater expansion at the lower temperatures for the cristobalite body and no characteristic sudden volume change at 573°C as was the case with the quartz body.

(4) Crucibles were subjected to a quenching test from 400°C to running water at 20°C, in which both bodies failed, but all indications showed the cristobalite to be the weaker body.

Conclusion

This experiment showed no beneficial results from the use of cristobalite in a vitreous whiteware body.

[1] S. S. Cole, "Conversion of Quartz into Cristobalite below 1000°C and Some Properties of the Cristobalite Formed," *Jour. Amer. Ceram Soc.*, **18** [5] 149–54 (1935).

IV, Production of a Cone 4 Single-Fire Wall-Tile Body High in Pyrophyllite

By Lee M. Hedges

The use of pyrophyllite gives promise as a material to be incorporated in a whiteware body to produce a "one-fire" wall-tile body at a reduced temperature. Beginning with a more or less standard pyrophyllite wall-tile body, which matures from cones 7 to 9, it was decided to at-

tempt to reduce its maturing temperature by the use of a low-fusion ball clay as well as by the addition of auxiliary fluxes.

The standard pyrophyllite body had this composition:

	(%)
Flint	15
Buckingham feldspar	3
Old Mine Ky. No. 4 ball clay	16
Georgia kaolin	18
Pyrophyllite	40
Whiting	2
Magnesite	1
Tremolitic talc	5
	100

The low-fusion ball clay selected was Old Mine Ky. No. 4 ball clay.

Two auxiliary fluxes were selected from Collin's work.[2]

The composition of these two fluxes are as follows:

Flux No. 1	
$CaSiO_3$	15%
Na_2SiO_3	60
Buckingham feldspar	25
	100%

Flux No. 2	
$BaSiO_3$	30%
Na_2SiO_3	45
Buckingham feldspar	25
	100%

About fifty bodies were prepared for dry pressing. Tile, 2 by 2 by 1/4 inch, were pressed, measured with a micrometer, and fired to cone 4.

[2] P. F. Collins, "Auxiliary Fluxes in Ceramic Bodies," *Jour. Amer. Ceram. Soc.*, **15** [1] 17–27 (1932).

TABLE II

	Base	Base	1	2	3	1	2	3	4	5	6
(1) Flint	15	10	10	10	10	10	10	10	10	10	10
(2) Feldspar (Buckingham)	3	3	2	1	0	3	3	3	3	3	3
(3) Ky. No. 4 ball clay	16	24	24	24	24	23	22	21	20	19	15
(4) Ga. kaolin	18	20	20	20	20	20	20	20	20	20	20
(5) Pyrophyllite	40	35	35	35	35	35	35	35	35	35	35
(6) Whiting	2	2	2	2	2	2	2	2	2	2	2
(7) Magnesite	1	1	1	1	1	1	1	1	1	1	1
(8) Talc	5	5	5	5	5	5	5	5	5	5	5
(9) Flux		0	1	2	3	1	2	3	4	5	9
With Flux No. 1											
(*a*) Absorption		10.8	11.8	12.2	9.4	10.4	8.8	5.8	3.0	6.2	4.0
(*b*) Shrinkage		4.5	4.5	4.0	6.5	5.5	5.5	6.5	9.3	5.7	5.0
(*c*) Moisture expansion		0.10	0.05	0.05	0.025	0.175	0.15	0.025	0.10	0.05	0.025
With Flux No. 2											
(*a*) Absorption			12.5	12.2	10.7	11.0	7.6	6.7	8.6	5.5	1.9
(*b*) Shrinkage			3.0	4.0	4.7	4.2	5.5	6.0	5.3	6.0	7.8
(*c*) Moisture expansion			0.025	0.10	0.05	0.10	0.025	0.05	0.05	0.125	0.075

	Base	1	2	1	2	3	4	5	6	1	2	3	1	2
(1)*	10	10	10	10	10	10	10	10	10	15	15	15	15	15
(2)	2	1	0	2	2	2	2	2	2	2	1	0	3	3
(3)	30	30	30	29	28	27	26	25	20	16	16	16	16	16
(4)	20	20	20	20	20	20	20	20	20	18	18	18	18	18
(5)	34	34	34	34	34	34	34	34	34	40	40	40	40	40
(6)	2									2	2	2	1	0
(7)										1	1	1	1	1
(8)	4	4	4	4	4	4	4	4	4	5	5	5	5	5
(9)	0	1	2	1	2	3	4	5	10	1	2	3	1	2
With Flux No. 1														
(*a*)†	12.5	12.2	11.8	11.7	11.4	10.8	10.4	7.8	5.0	13.8	12.3	10.7	12.2	11.1
(*b*)	2.5	2.5	3.5	3.5	3.5	3.5	3.7	4.3	4.7	2.7	2.8	3.0	3.0	3.4
(*c*)	0.10	0.10	0.075	0.125	0.075	0.10	0.075	0.075	0.05	0.025	0	0.05	0	0.10
With Flux No. 2														
(*a*)		12.9	12.8	11.6	10.8	10.8	10.0	8.6	6.7	14.5	14.5	12.3	13.7	12.4
(*b*)		3.0	2.8	3.5	3.7	3.6	4.7	4.7	4.7	1.7	2.0	2.5	1.5	2.7
(*c*)		0.10	0.10	0.10	0.075	0.10	0.075	0.10	0	0.025	0.05	0.05	0.10	0.05

* These numbers correspond to materials in the first section of this table.
† Letters correspond to above flux characteristics.

The tile were remeasured after firing and the total shrinkages of the various bodies were determined. All tile were subjected to an autoclave treatment of 150 pounds per square inch pressure for a period of three hours. The moisture expansion was determined and noted.

In the introduction of the low-fusion ball clay, this clay replaced part of the flint and part of the pyrophyllite in the standard body. The auxiliary fluxes were introduced to replace first the feldspar, then part of the ball clay, and finally the whiting and the magnesite.

The experimental bodies with the results obtained are given in Table II.

Summary

(1) It was found that the auxiliary fluxes were more satisfactory in reducing the vitrification of the standard body.

(2) An addition of 3 to 4% flux is required to obtain the desired vitrification at cone 4.

(3) Of the two auxiliary fluxes, No. 1 flux, that flux containing calcium silicate is the more active, producing slightly lower absorption and greater shrinkage than the flux containing barium silicate.

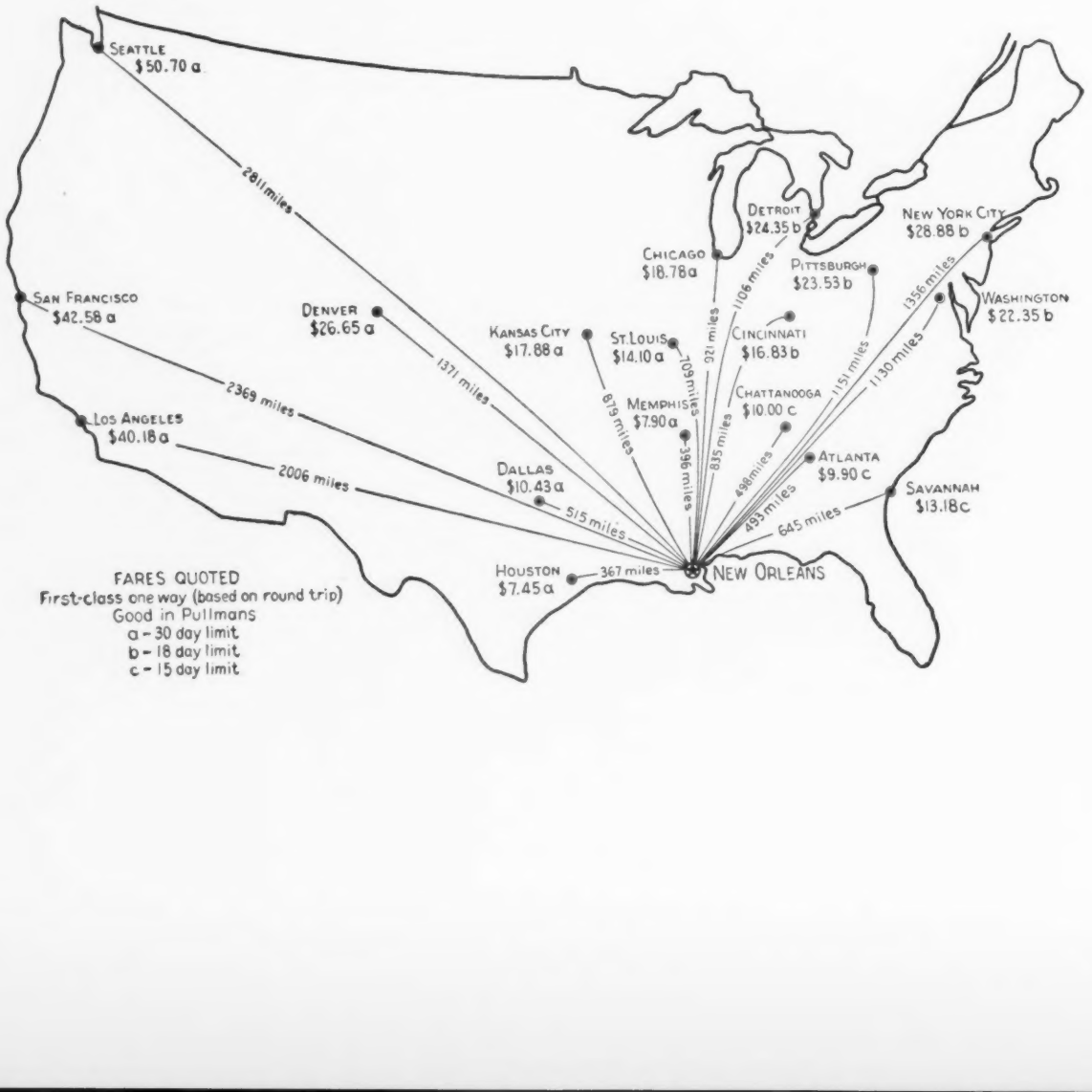
(4) The barium flux, flux No. 2, was found to be less erratic in its firing behavior. It gave a slower and a more even vitrification.

Conclusion

Practically all bodies containing 3 to 4% flux No. 2 had a satisfactory porosity and shrinkage and an improved moisture expansion. It is assumed that those bodies would serve as a basis for more extensive tests to prove the advisability of their use for the commercial production of "one-fire" cone 4 wall tile.

No attempt was made to fit a glaze to these bodies.

New York State College of Ceramics
Alfred, New York



ACTIVITIES OF THE SOCIETY

ROSTER OF SAILORS SHOWS INCREASE

Though not up to the March peak at which time the "Good Ship Ceramics" was cleared of all stowaways (those who failed to pay dues), yet over the past twelve months there has been a net gain of 250 paid Members, thirty of whom are Corporations.

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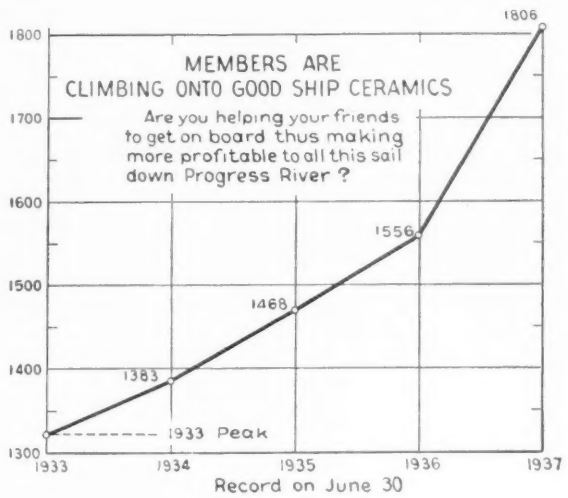
1937 MEMBERSHIP RECORD

Date of Record	Members Paid: Personal	Members Paid: Corporation	Deferred	Subscriptions	Monthly Sales	Total Circulation
December 20, 1936	1452	196				
January 20, 1937	1478	199				
February 23, 1937	1579	210	19	515	220	2543
March 29, 1937	1613	212	18	524	220	2587
April 23, 1937	1517	209	29	485	220	2460
May 22, 1937	1541	209	25	501	220	2496
June 22, 1937	1572	211	23	502	220	2528
June 26, 1936	1332	181	43	495	200	2251
12-Month Gain	240	30	20	7		277



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Carr-Lowrey Glass Co., Baltimore, Md.
Celo Mines, Inc., Burnsville, N. C.
Central Silica Company, R. F. D., Glenford, Ohio
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Certain-Teed Products Corp., Military Road, Buffalo, N. Y.
Champion Spark Plug Co., Ceramic Division, Detroit, Mich.
Chicago Hardware Foundry Co., North Chicago, Ill.
Chicago Pottery Co., 1920 Clybourn Ave., Chicago, Ill.
Chicago Vitreous Enamel Product Co., 1407 S. 55th Court, Cicero, Ill.
Clark, N., & Sons, 116 Natoma St., San Francisco, Calif.
Clay Products Assn., 111 W. Washington St., Chicago, Ill.
Clay Products Co., Inc., of Indiana, Brazil, Ind.
Columbian Enameling & Stamping Co., Terre Haute, Ind.
Coors Porcelain Company, Golden, Colo.
Corhart Refractories Co., Inc., 16th & Lee Sts., Louisville, Ky.
Corning Glass Works, Corning, N. Y.
Corning Glass Works, Macbeth-Evans Division, Charleroi, Pa.
Cortland Grinding Wheels Co., Chester, Mass.
Crane Enamelware Co., Chattanooga, Tenn.
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Crossley Machine Company, Trenton, N. J.
Crossman Company, South Amboy, N. J.
Crown Potteries Company, Evansville, Ind.

Denver Sewer Pipe & Clay Co., Broadway at Curtis, Denver, Colo.
Detroit Electric Furnace Co., 825 W. Elizabeth St., Detroit, Mich.
DeVilbiss Manufacturing Co., Toledo, Ohio
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Drakenfeld, B. F., & Co., 45–47 Park Place, New York, N. Y.
Du Pont de Nemours, E. I., & Co., R. & H. Chemical Dept., Wilmington, Del.

Edgar Plastic Kaolin Co., Metuchen, N. J.
Electro Refractories & Alloys Corp., 662 Andrews Bldg., Buffalo, N. Y.
Ellis, Sherman C., Middletown, Conn.
Engelhard, Charles, Inc., 90 Chesnut St., Newark, N. J.
English China Clays Sales Corp., 551 Fifth Ave., New York, N. Y.
Eureka Flint & Spar Co., Box 266, Trenton, N. J.
Exolon Company, Blasdell, N. Y.

Federal Seaboard Terra Cotta Corp., Perth Amboy, N. J.
Ferro Enamel Corp., 4150 E. 56th St., Cleveland, Ohio
Findlay Clay Products Co., Washington, Pa.
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Ford Ceramic Arts, Inc., 319 W. 10th Ave., Columbus, Ohio
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Frazier-Simplex, Inc., Washington Trust Bldg., Washington, Pa.

Gayner Glass Works, Salem, N. J.
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Gillinder Brothers, Inc., Port Jervis, N. Y.
Gladding, McBean, & Company, Lincoln, Placer County, Calif.
Gleason-Tiebout Glass Co., 59 54th St., Maspeth, N. Y.
Glenwood Range Company, Taunton, Mass.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit, Mich.
Great Lakes Steel Corp., Tecumseh Road, Ecorse, Detroit, Mich.
Green, A. P., Fire Brick Co., Research Dept., Mexico, Mo.

Haeger Potteries, Inc., Dundee, Ill.
Hall China Company, East Liverpool, Ohio
Hanley Company, Summerville, Pa.
Hanovia Chemical & Mfg. Co., Chesnut St. & N. J. R. R. Ave., Newark, N. J.
Hardinge Company, Inc., York, Pa.
Harshaw Chemical Co., Intelligence Service Div., 1945 E. 97th St., Cleveland, Ohio
Hartford-Empire Co., P. O. Box 1620, Hartford, Conn.
Hazel-Atlas Glass Co., Zanesville, Ohio
Hocking Glass Company, Lancaster, Ohio
Hommel, O., Co., 209 4th Ave., Pittsburgh, Pa.
Houze, L. J., Convex Glass Co., Point Marion, Pa.

Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Ingram-Richardson Mfg. Company of Indiana, Inc., Frankfort, Ind.
International Smelting & Refining Co., White Lead Dept., Akron, Ohio
Irish Glass Bottle Co., Ltd., Charlotte Quay, Dublin, Ireland
Ironton Fire Brick Co., Ironton, Ohio
Isolantite, Inc., 343 Cortlandt St., Belleville, N. J.

Jova Brick Works, Roseton, N Y.

Kaolin, Incorporated, Spruce Pine, N. C.
Kentucky Clay Mining Co., Mayfield, Ky.
Kentucky-Tennessee Clay Co., Paris, Tenn.

Knowles, Edwin M., China Co., Newell, W. Va.
Kohler Company, Kohler, Wis.
Koppers Construction Co., Research Division, 713 Koppers Bldg., Pittsburgh, Pa.
Kraftile Company, Niles, Calif.

Laclede-Christy Clay Products Co., 1711 Ambassador Bldg., St. Louis, Mo.
Lancaster Iron Works, Lancaster, Pa.
Lapp Insulator Co., Inc., Le Roy, N. Y.
Laughlin, Homer, China Co., Newell, W. Va.
Lava Crucible Co. of Pittsburgh, 627 Wabash Bldg., Pittsburgh, Pa.
Lee Clay Products Company, Clearfield, Ky.
Libbey Glass Company, W. & L. E. R.R., Ash St., Toledo, Ohio
Lindemann, A. J., & Hoverson Co., Milwaukee, Wis.
Locke Insulator Corp., Box A, Baltimore, Md.
London Brick Co. & Forders, Ltd., Africa House, Kingsway, London, W. C. 2, England
Louthan Manufacturing Co., East Liverpool, Ohio

Maryland Glass Corp., Morrell Park Sta., Baltimore, Md.
Mason City Brick & Tile Co., Mason City, Iowa
Matawan Tile Company, Matawan, N. J.
McKee, Arthur G., & Co., 2422 Euclid Ave., Cleveland, Ohio
McLain Fire Brick Co., Central Office, Wellsville, Ohio
Metal & Thermit Corp., 120 Broadway, New York, N. Y.
Mid-West Brick Co., P. O. Box 436, Ottawa, Ill.
Mississippi Glass Co., 220 Fifth Ave., New York, N. Y.
Moore & Munger, 33 Rector St., New York, N. Y.
Mosaic Tile Company, Zanesville, Ohio
Mt. Clemens Pottery Co., Mt. Clemens, Mich.

National Aluminate Corp., 6216 W. 66th Place, Chicago, Ill.
National Fireproofing Corp., 202 E. Ohio St., N. S., Pittsburgh, Pa.
National Lime & Stone Co., First National Bldg., Findlay, Ohio
Newbold Silica Fire-Brick Co., Ltd., G. P. O. Box No. 3407 R, Sydney, N. S. W., Australia
New Castle Refractories Co., New Castle, Pa.
New Jersey Porcelain Co., P. O. Box 908, Trenton, N. J.
New Jersey Pulverizing Co., 205 W. 34th St., New York, N. Y.
Nippon Gaishi Kabushiki Kaisha, Atsuta Minamiku, Nagoya, Japan
Nippon Toki Kaisha, Ltd., Noritake, Nagoya City, Japan
North American Refractories Co., National City Bank Bldg., Cleveland, Ohio
North Carolina Feldspar Corp., Erwin, Tenn.
Norton Company, Worcester, Mass.

Ohio Insulator Company, Library, Barberton, Ohio
Onondaga Pottery Co., Syracuse, N. Y.
Orton, Edward, Jr., Ceramic Foundation, 1445 Summit St., Columbus, Ohio
Owens-Illinois Glass Co., Alton, Ill.
Owens-Illinois Pacific Coast Co., 15th & Folsom Sts., San Francisco, Calif.

Pacific Clay Products, Box 145, Sta. A, Los Angeles, Calif.
Paper Makers Importing Co., Inc., 640 N. 13th St., Easton, Pa.
Pass & Seymour, Inc., Solvay, N. Y.
Pennsylvania Pulverizing Co., Box 587, Lewistown, Pa.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
Pfaudler Company, Rochester, N. Y.
Pittsburgh Plate Glass Co., Creighton, Pa.
Pomona Tile Manufacturing Co., 629–33 N. La Brea Ave., Los Angeles, Calif.
Pope-Gosser China Co., Coshocton, Ohio
Porcelain Enamel & Mfg. Co., Eastern & Pemco Aves., Baltimore, Md.
Potters Supply Company, East Liverpool, Ohio

Quigley Company, Inc., 56 West 45th St., New York, N. Y.

Republic Steel Corp., Republic Bldg., Youngstown, Ohio
Rickmann & Rappe, Chemische Fabriken, Koln-Kalk, Germany
Riddell, W. A., Co., Bucyrus, Ohio
Roberts & Mander Stove Co., Hatboro, Pa.
Roseville Pottery Co., Zanesville, Ohio
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Rundle Manufacturing Co., 3305 W. Forest Home Ave., Milwaukee, Wis.
Rustless Iron Co., Ltd., Trico Works, Keighley, England

Safety Grinding Wheel & Machine Co., Wheel & Larch Sts., Springfield, Ohio
Salem China Company, Salem, Ohio
San Miguel Brewery, Inc., Manila, P. I.
Sebring Pottery Company, Sebring, Ohio
Shenango Pottery Company, New Castle, Pa.
Simonds Worden White Co., N. Summit St. & Negley Place, Dayton, Ohio
Smith & Stone, Ltd., Georgetown, Ontario, Canada
Solar Laboratories, Beaver, Pa.
Solvay Process Company, Syracuse, N. Y.
Southern California Gas Co., 1700 Santa Fe Ave., Los Angeles, Calif.
Spinks, H. C., Clay Co., 52 Monmouth St., Newport, Ky.
Square D Company, 6060 Rivard St., Detroit, Mich.
Standard Sanitary Mfg. Co., 1541 S. 7th St., Louisville, Ky.
Star Porcelain Co., Muirhead Ave., Trenton, N. J.
Stark Ceramics, Inc., Box 258, Canton, Ohio
Steele, J. C., & Sons, Statesville, N. C.
Summitville Face Brick Co., H. K. Lynn, Summitville, Ohio
Sur Enamel & Stamping Works, Ltd., 9 Middle Road Entally, Calcutta, India
Swindell Brothers, Bayard & Russell Sts., Baltimore, Md.
Swindell-Dressler Corp., P. O. Box 1753, Pittsburgh, Pa.

Taylor, Smith, & Taylor Co., Chester, W. Va.
Toyo Toki Kwaisha Shinozaki, Kokura City, Japan
Trenton Potteries, P. O. Box 141, Trenton, N. J.
Tyler, W. S., Company, Cleveland, Ohio

Union Française des Produits Refractaires, 15 Rue de Milan, Paris 9e, France

United Clay Mines Corp., Oakland & Prospect Sts., Trenton, N. J.
United States Gypsum Co., 300 West Adams St., Chicago, Ill.
Universal Clay Products Co., Sandusky, Ohio
Universal Dental Company, 48th & Brown Sts., Philadelphia, Pa.
Universal Sanitary Manufacturing Co., New Castle, Pa.
Verreries Souchon Neuvesel, Siege Social, a Lyon 8, 10 Rue de la Bourse, France
Vesuvius Crucible Co., Box 29, Swissvale, Pa.
Vitrefrax Corporation, 5050 Pacific Blvd., Los Angeles, Calif.
Vitreous Steel Products Co., Station D., Cleveland, Ohio
Vitro Manufacturing Co., Corliss Sta., Pittsburgh, Pa.
Vollrath Company, Sheboygan, Wis.

Wallace China Co., Ltd., Box 47, Huntington Park, Calif.
Waltham Grinding Wheel Co., Waltham, Mass.
Wayne Laboratories, 17 East Main St., Waynesboro, Pa.
Western Brick Co., Danville, Ill.
Western Electric Co., Hawthorne Sta., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Derry, Pa.
Wheeling Steel Corp., Portsmouth, Ohio
Whitall-Tatum Company, Millville, N. J.

NEW MEMBERS

Corporation

*LANCASTER IRON WORKS, INC., James P. Martin (voter), Lancaster, Pa.
MASON CITY BRICK & TILE CO., W. H. Rees (voter), Mason City, Ia.

Personal

BAGER, FREDERIC E., T. L. Smith Co., 2835 N. 32nd St., Milwaukee, Wis.
BOREN, JOHN A., Pomona, N. C.; dealer in pyrophyllite.
DAY, RALPH K., 21 West First St., Corning, N. Y.; physicist.
FIELD, THEODORE E., 16th & Lee Sts., Louisville, Ky.; head of chemical research, Corhart Refractories.
FOSTER, JOHN A., 9591 Sorrento Ave., Detroit, Mich.; ceramist, Ford Motor Co., Dearborn, Mich.
HUMMEL, ROY, 2343 Georgetown Ave., Toledo, Ohio; Electric Auto Lite Spark Plug Plant, Fostoria, Ohio.
HUNTER, RICHARD S., National Bureau of Standards, Washington, D. C.; physical science aid (optics).
NEWMAN, ROBERT W., 2729 Derbyshire Rd., Cleveland Heights, Ohio; chemical engineer, Pitney Glass Works, General Electric Co.
SATO, SHIKAO, 120 Broadway, Room 1151, New York, N. Y.; representative, Asahi Glass Co., Japan.
STAMEY, ROBERT B., Soil Conservation Service, Greensboro, N. C.; assistant agricultural engineer.
SULLIVAN, GERALD D., 34 S. Cleveland Ave., Mogadore, Ohio; salesman, F. E. Schundler & Co., Joliet, Ill.
WISHOSKI, I. STANLEY, 1101 Union Trust Bldg., Pittsburgh, Pa.; editor, *Industrial Heating*, National Industrial Publishing Co.

* Indicates former member of the Society rejoining for 1937.

Student

New York State College of Ceramics

HAND, RALPH D., R. F. D. 3, Addison, N. Y.
JONES, RODNEY A., Box 103, Alfred, N. Y.
OVERHISER, ELMER H., Beaver Dams, N. Y.
REID, JOHN O., 622 Bergen Ave., Jersey City, N. J.
SMITH, ALFRED W., Box 250, Fonda, N. Y.
SMOCK, ALDEN W., 248 E. Fourth St., Corning, N. Y.

Ohio State University

FRENCH, PRESTON W., Mellon Institute, Pittsburgh, Pa.
POON, CHO FUN, Eastern Trading Co., Bank of China Bldg., Hong Kong, China.
TEPLETSKY, HYMAN, 23 Chittenden Ave., Columbus, Ohio.

Virginia Polytechnic Institute

CARSON, B. R., JR., Wakefield, Va.

MEMBERSHIP WORKERS' RECORD

Corporation

Office	2

Personal

A. F. Greaves-Walker	2	L. G. Tait	1
W. N. Harrison	1	Robert Twells	1
R. B. Sosman	5	Office	2

Student

A. E. Baggs	1	A. S. Watts	1
R. B. Sosman	7	J. W. Whittemore	1
		Grand Total	**24**

ROSTER CHANGES DURING JUNE*

Personal

CIBELLA, ROSS C., Hall Laboratories, Inc., 300 Ross St., Pittsburgh, Pa. (South Amboy, N. J.)
EDDY, MAXSON A., Owens-Illinois Glass Co., Terre Haute, Ind. (Streator, Ill.)
KERR, CHARLES H., 307 Gravilla St., LaJolla, Calif. (Covina, Calif.)
LECHNER, ERNEST A., 630 Henry Ave., Wellsville, Ohio. (Pittsville, Wis.)
MAHAFFY, WENDEL A., Owens-Illinois Pacific Coast Co., 15th & Folsom, San Francisco, Calif. (Creighton, Pa.)
MCCANN, F. A., 714 Heatherside Rd., Pasadena, Calif. (Avalon, Calif.)
MCELROY, WILLIAM D., United Gas Improvement Co., Engineering Lab., Tilghman St. Gas Plant, Chester, Pa. (Philadelphia, Pa.)
METZGER, A. J., Elgin-Butler Brick Co., Austin, Texas. (Cincinnati, Ohio.)

NORDAL, JOHANNES G., National Sewer Pipe Co., Ltd., Wentworth St. North, Hamilton, Ont., Canada. (Theodore, Sask.)

POWELL, WILLIAM R., 907 N. Calhoun St., Mexico, Mo. (Jackson, Ohio.)

SILK, KARL, Sandy Rd., Norton, Stourbridge, England. (Stone Staffs, England.)

STEVENS, ROBERT P., Charles Taylor Sons Co., Box 58, Annex Sta., Cincinnati, Ohio. (Cayuga, Ind.)

TERRY, GRIFFIN E., Edison General Electric Appliance Co., Inc., Engineering Dept., 5600 W. Taylor St., Chicago, Ill. (Detroit, Mich.)

WILLETTS, PAUL G., JR., 189 Marvelwood Rd., Westville, New Haven, Conn. (West Hartford, Conn.)

Student

BROOKS, SYDNEY J., 9110 Parkgate Ave., Cleveland, Ohio. (Ohio State Univ.)

BROUK, J. JOHN, 3145 Russell Blvd., St. Louis, Mo. (Univ. of Illinois)

CAYFORD, JAMES M., Glascote Products, Inc., 20900 St. Clair Ave., Cleveland, Ohio. (Mass. Inst. of Technology)

CLEEVES, GEORGE A., 282 Massachusetts Ave., Cambridge, Mass. (Pennsylvania State College)

FOOTE, E. H., JR., Akron Rd., Medina, Ohio. (Virginia Polytechnic Inst.)

GREEN, M. EDWARD, 527 N. Cottage Street, Taylorville, Ill. (Missouri School of Mines)

KUNZMAN, EDWARD E., 317 Spruce Ave., Niagara Falls, N. Y. (New York State College of Ceramics)

MADDEN, ROBERT H., 2709 Avenue E, Ensley, Ala. (Univ. of Alabama)

MARTIN, ALLAN E., 2939 Taylor St., N. E., Minneapolis Minn. (Pennsylvania State College)

MOSES, SIDNEY A., Utah Fire Clay Co., Salt Lake City, Utah. (Ohio State Univ.)

MULQUEENY, THOMAS J., 613 Forest Ave., Alton, Ill. (Univ. of Illinois)

REA, ROBERT F., Denver Fire Clay Co., Box 5510, Denver, Colo. (Ohio State Univ.)

SOLOMON, ROBERT, 957 Simpson St., Bronx, New York, N. Y. (Univ. of Alabama)

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* Address in parentheses is the old address.

MEMBERSHIP WORKERS' RECORD, JANUARY, 1936, TO JULY, 1937

IS YOUR NAME ON THIS LIST? ARE YOU SATISFIED?

Securing new members for the American Ceramic Society is an interesting game. Those who work actively at this business testify that their interest in the Society is immeasurably heightened by their work. Because they are "selling" the Society to persons who are not acquainted with its organization and benefits, they are constantly reviewing for themselves the advantages of their own Society affiliation. A good way to test your appreciation of *your* membership is to outline the points whereby you believe you are being benefited by your membership. Once this is done, getting new members is a simple procedure. Line up your prospective names and then review the advantages you find in holding your membership; new members will join at your invitation and your Society will be able to increase its service for its entire membership body.

7 Andrews, A. I., Urbana, Ill.
2 Arnold, R. E., Akron, Ohio.
1 Astles, W., London, England.
2 Austin, C. R., Columbus, Ohio.
1 Austin, J. B., Kearny, N. J.
1 Ayars, Alice A., Cleveland Heights, Ohio.
1 Babcock, M. G., Pittsburgh, Pa.
1 Baggs, A. E., Columbus, Ohio.
5 Bales, C. E., Ironton, Ohio.
1 Barton, G. E., Millville, N. J.
2 Beam, J. R., New Castle, Pa.
1 Bennett, D. G., Pittsburgh, Pa.
1 Birch, R. E., Pittsburgh, Pa.
1 Bleininger, A. V., Newell, W. Va.
1 Blodgett, Malcolm, Woburn, Mass.
1 Booze, M. C., Cincinnati, Ohio.
1 Borkey, J. H., Philadelphia, Pa.
1 Bowman, R. M., Cleveland, Ohio.
4 Bradley, R. S., Mexico, Mo.
1 Brenner, R. F., Lancaster, Ohio.
3 Brian, Charles, Easton, Pa.
3 Brown, G. H., New Brunswick, N. J.
1 Brown, L. H., East Liverpool, Ohio
2 Burchfiel, B. M., Los Angeles, Calif.
1 Burgess, B. C., Spruce Pine, N. C.
1 Campbell, R. M., Alfred, N. Y.
1 Campbell, Thomas, Sydney, N. S. W., Australia.
1 Carothers, R. B., Newport, Ky.
8 Carruthers, J. L., Columbus, Ohio.
1 Carter, J. D., Philadelphia, Pa.
1 Chesters, J. H., Stocksbridge, near Sheffield, England.
1 Clark, R. J., Philadelphia, Pa.
2 Cohn, W. M., Berkeley, Calif.
1 Coss, H. T., Manville, N. J.
1 Cox, P. E., Ames, Iowa.
1 Crabb, Harriett, Mason City, Iowa.
1 Crawford, G. E., Kittanning, Pa.
1 Crawley, E. J., Sheffield, England.
1 Cruikshank, J. L., Detroit, Mich.
3 Curtis, T. S., Huntington Park, Calif.
1 Dager, P. W., Detroit, Mich.
1 Danielson, R. R., Carteret, N. J.
1 Deeth, H. R., Lakefield, Ont., Canada.
3 Diamond, G. S., Hamburg, N. Y.
5 Dodd, C. M., Rolla, Mo.
3 Dyer, Mrs. A. R., East Cleveland, Ohio.
1 Easter, G. J., Niagara Falls, N. Y.
1 Emery, Walter, Stoke-on-Trent, England.
2 Everhart, J. O., Columbus, Ohio.
1 Fabianic, W. L., Alton, Ill.
1 Faust, G. T., New Brunswick, N. J.
1 Finn, A. N., Washington, D. C.
2 Flint, F. C., Zanesville, Ohio.
1 Fosdick, Marion, Alfred, N. Y.
1 Frazier, J. E., Washington, Pa.
1 Fréchette, Howells, Ottawa, Ont., Canada.
1 Geiger, C. F., Perth Amboy, N. J.
1 Gerster, C. W., East Liverpool, Ohio.
7 Greaves-Walker, A. F., Raleigh, N. C.
1 Green, J. R., Philadelphia, Pa.
2 Gregorius, J. S., Creighton, Pa.
2 Hagar, Donald, Zanesville, Ohio.
1 Hanna, R. E., Anderson, Ind.
1 Hansen, J. E., Cleveland, Ohio.
1 Hanson, G. G., Chicago, Ill.

1 Hardy, R. G., Coffeyville, Kansas.
3 Harrison, W. N., Washington, D. C.
1 Hartford, F. M., Cleveland, Ohio.
1 Harvey, F. A., Pittsburgh, Pa.
3 Heath, F. T., Jr., Worcester, Mass.
1 Heindl, R. A., Washington, D. C.
1 Herold, J. F., Glendale, Calif.
1 Hewitt, L. C., St. Louis, Mo.
1 Hill, E. C., Philadelphia, Pa.
6 Holmes, M. E., Alfred, N. Y.
2 Hostetter, J. C., Hartford, Conn.
2 Hugill, William, Alsager, England.
1 Hull, W. A., Sante Fe, N. Mex.
3 Hursh, R. K., Urbana, Ill.
1 Jarman, G. W., Jr., New York, N. Y.
1 Kay, W. T., Seattle, Wash.
2 Kelsey, V. V., Trenton, N. J.
1 Knauft, R. W., Cincinnati, Ohio.
1 Knowles, W. V., Cleveland Heights, Ohio.
1 Kraner, H. M., Bethlehem, Pa.
1 Kreidl, Werner, Vienna, Austria.
1 Lee, P. W., Chicago, Ill.
1 Long, R. N., Taylor, Ky.
3 McAfee, W. K., New Castle, Pa.
1 McCann, F. A., Pasadena, Calif.
1 McCauley, G. V., Corning, N. Y.
1 McGregor, R. R., Pittsburgh, Pa.
3 McIntyre, G. H., Cleveland, Ohio.
4 McKinley, J. M., East Cleveland, Ohio.
3 McVay, T. N., University, Ala.
2 Mitchell, Lane, Atlanta, Ga.
2 Mohr, J. G., Perth Amboy, N. J.
2 Moulton, D. A., Evansville, Ind.
1 Navias, Louis, Schenectady, N. Y.
8 Norton, F. H., Cambridge, Mass.
1 Palmer, W. E., East Liverpool, Ohio.
4 Parmelee, C. W., Urbana, Ill.
1 Petrie, Earl C., Pittsburgh, Pa.
1 Pfeiffer, W. H., Dayton, Ohio.
1 Radcliffe, B. S., Chicago, Ill.
1 Rhead, F. H., Newell, W. Va.
1 Robinson, R. R., Zelienople, Pa.
2 Robson, J. T., Cleveland, Ohio.
1 Rochow, W. F., Pittsburgh, Pa.
1 Romine, H. E., Pittsburgh, Pa.
2 Scholes, S. R., Alfred, N. Y.
1 Sharp, D. E., West Hartford, Conn.
1 Sievert, G. E., South Gate, Calif.
3 Silverman, Alexander, Pittsburgh, Pa.
2 Simpson, H. E., Pittsburgh, Pa.
13 Sosman, R. B., Kearny, N. J.
1 Steger, W., Berlin-Grunewald, Germany.
1 Stevens, Joe, Vernon, Calif.
1 Strod, A. J., Pittsburgh, Pa.
1 Sullivan, J. D., Columbus, Ohio.
2 Sutphen, F. J., Middletown, Ohio.
1 Svec, J. J., Wheeling, W. Va.
2 Tait, L. G., Detroit, Mich.
1 Talwalkar, T. W., Poona City, India.
5 Taylor, N. W., State College, Pa.
2 Thompson, C. L., Pittsburgh, Pa.
2 Turner, W. E. S., Sheffield, England.
1 Twells, Robert, Fostoria, Ohio.
2 Vaughan, W. H., Atlanta, Ga.
1 Vickers, A. E. J., Norton-on-Tees, England.
1 Vieweg, Hermann, Highland Park, N. J.
1 Waite, V. H., Berea, Ohio.
4 Watts, A. S., Columbus, Ohio.
1 Weldon, W. A., Baltimore, Md.
1 Wenning, W. F., New Brighton, Pa.
1 Weyl, Woldemar, State College, Pa.
4 Whittemore, J. W., Blacksburg, Va.
1 Williams, F. J., Pittsburgh, Pa.
5 Wilson, Hewitt, Seattle, Wash.
1 Wiss, J. E., Columbus, Ohio.
2 Wolfram, H. G., Baltimore, Md.

SCHEDULED AUTUMN MEETINGS

REFRACTORIES DIVISION

PLACE: *Bedford Springs, Pa.

DATE: September 3 and 4

DISCUSSION TOPIC: Boiler Refractories

Bedford Springs, Pa., is located about one and one-half miles from the town of Bedford, Pa., which is on the Lincoln Highway, 99 miles east of Pittsburgh and 199 miles west of Philadelphia. A branch line of the Pennsylvania Railroad goes through Bedford Springs. This connects with the main line of the Pennsylvania Railroad at Altoona, Pa., or the main line of the Baltimore & Ohio at Cumberland. Service on the main line of the Pennsylvania is provided from Huntingdon, Pa., to Bedford.

H. M. KRANER, Bethlehem Steel Co., Bethlehem, Pa., *Division Chairman*

J. B. AUSTIN, U. S. Steel Corp., Kearny, N. J., *Program Chairman*

* For map see page 315.

GLASS DIVISION

PLACE: State College, Pa.

DATE: September 10 and 11

A. N. FINN, National Bureau of Standards, Washington, D. C., *Division Chairman*

N. W. TAYLOR, Dept. of Ceramics, Pennsylvania State College, *Program Chairman*

L. C. ROCHE, Maryland Glass Corp., *Program Chairman*

WHITEWARES DIVISION AND MATERIALS AND EQUIPMENT DIVISIONS

Joint Autumn Meeting

PLACE: Pocono Mountain Region of eastern Pennsylvania

DATE: September 16 and 17

Outline of the program and name of the inn selected will be announced in the next issue of *The Bulletin*.

R. F. GELLER, National Bureau of Standards, Washington, D. C., *White Wares Division Chairman*

R. M. CAMPBELL, N. Y. State College of Ceramics, Alfred, N. Y., *White Wares Program Chairman*

J. E. EAGLE, Vitro Mfg. Co., Corliss Sta., Pittsburgh, Pa., *Materials and Equipment Division Chairman*

H. B. DUBOIS, Consolidated Feldspar Corp., East Liverpool, Ohio, *Materials and Equipment Program Chairman*

OTHER CERAMIC MEETINGS

CERAMIC ASSOCIATION OF NEW YORK
Alfred, N. Y., October 8 and 9.

PORCELAIN ENAMEL INSTITUTE
Chicago, Ill., October 12 and 13.

OHIO CERAMIC INDUSTRIES ASSOCIATION (ANNUAL MEETING)
Columbus, Ohio, November 5 and 6.

The emblem (seal) of the American Ceramic Society as it appears in the new Mellon Institute of Industrial Research, Pittsburgh, Pa.

RECEPTION AND BUFFET LUNCHEON AT SOCIETY HEADQUARTERS

The members of the Central Ohio Local Section entertained with an informal reception at the Society's executive offices on Monday, June 14, 1937, at 12:00 M. The honor guests were members of the Society who received honors at the Convocation exercises at Ohio State University.

Ellis Lovejoy, Past-President, received the Lamme Medal.

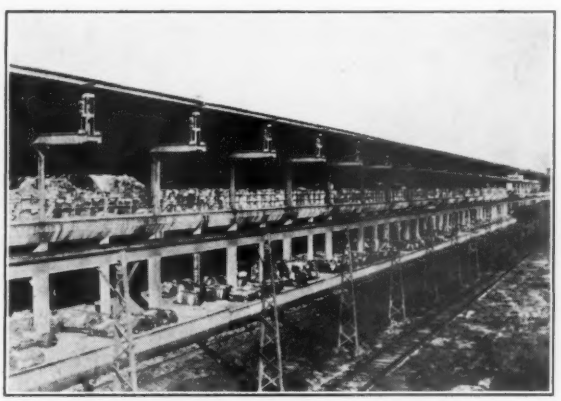
Carl E. Curtis and Robert F. Rea received the degree of Doctor of Science in Ceramic Engineering.

Professional degrees of Ceramic Engineer were conferred upon the following members: R. B. Sosman, President of the Society; E. E. Baldauf, R. E. Birch, Robert E. Gould, W. M. Hughes, T. A. Klinefelter, E. H. Lintz, D. M. McCann, J. T. Robson, L. J. Trostel, and R. C. Zehm.

A buffet luncheon was served by Mr. and Mrs. Ross C. Purdy assisted by members of the Society staff. About one hundred persons attended.

The guests enjoyed studying the pictures and the ceramic pieces which are on exhibit in the Society executive offices.

MAKE PLANS FOR THE 1938 (40TH) ANNUAL MEETING IN NEW ORLEANS MARCH 27—APRIL 2

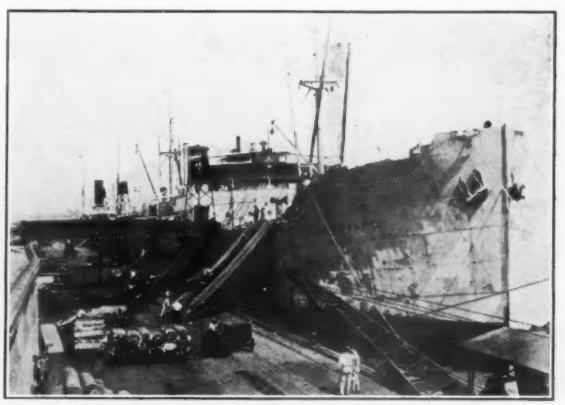


Cotton Warehouse, New Orleans

The public cotton warehouse in New Orleans is the largest in the world, offering 33 acres of covered warehouse space and an entire plant covering 48 acres.

Storage capacity is 461,856 high-density bales; daily unloading capacity is 7500 bales from cars and 2000 bales from barges or steamboats; daily loading capacity is 7500 bales to steamships. Four ocean vessels may load simultaneously at the wharf.

It is served by a 2-story wharf-house 1512 feet long, by a 45-foot wharf apron with railroad tracks at ship-side and by intra-plant rail switches which provide 258 car-settings, in addition to track storage capacity of 1000 cars which it shares with the public grain elevator. These are the tracks of the public belt railroad, available to all lines entering the city.



Loading Cotton at New Orleans

The New Orleans Cotton Exchange is ranked among the first three in the world. For the shipment of cotton and other commodities, New Orleans offers transportation facilities which are not excelled by any other city. Railroad trunk lines offer direct service from New Orleans to every important city in the South; barge lines operate to Minneapolis, St. Paul, Pittsburgh, Chicago, Birmingham, and other points; coastwise steamship service is available to the Atlantic, the Pacific, and to ports on the Gulf; foreign steamship service to and from New Orleans is more extensive and regular than from any other American port, except New York; overnight air-mail, express, and passenger service is offered to the major centers of this country.

THE PRESIDENT'S COLUMN

MEETING-PLACES

The ideal place for the Annual Meeting of the American Ceramic Society would be a place where 100% of the members would be sure to attend the Meeting and the technical sessions. It would matter very little whether it were Chicago, Columbus, or Cambridge, provided it could accommodate the crowd. For years the American Institute of Mining and Metallurgical Engineers has found it satisfactory to hold an annual meeting in New York, and the American Society for Testing Materials an annual meeting in Atlantic City.

It would seem that the next best place would be one where 75% of the members would be sure to attend, but that does not follow so simply. Suppose it were always the same 75%. The remaining 25% would have legitimate cause for complaint that they were being neglected. That is one reason why we should, now and again, meet in places rather far removed from our center of ceramic population.

Our internal affairs are not our only concern. The Society, though it is not a trade association, does have a function as a source of public education regarding the meaning of ceramics and the universality of ceramic products. The South contains a large unsaturated market for such products, but it needs to be told what products are available and what they are good for. It also needs to be told that it has within its own borders the raw materials, such as good clays and inexpensive fuels, for a thriving ceramic industry. New Orleans is a good center from which to disseminate such information.

The primary purposes of the Annual Meeting are the promotion of acquaintance and the interchange of experience among ceramists, and the presentation and discussion of technical papers. A large city is not the ideal place to promote such objects. A summer or winter resort with hotels large enough to furnish the necessary accommodations, but without so many distractions of business and entertainment, would seem a better place, and this fact is being recognized by an increasing number of organizations. One ceramist has suggested that we charter a steamship down the Ohio or across to Bermuda, and hold the meetings on board. This suggestion deserves more serious consideration than it at first seems entitled to, although I am told that a salesmen's convention tried the plan recently and found the good fellowship a little too concentrated; the chairman never succeeded in calling the meeting to order.

I did not find New York an entirely satisfactory meeting place. It is true that the Waldorf-Astoria was a distinctive center, ideally managed for such a meeting, and long to be remembered by its guests. But although the general attendance was probably the largest in the Society's history, some of the Divisional sessions were not as well attended as they have been at meetings where the total attendance was smaller. Distractions such as the visit of inspection to the "Queen Mary," intended for the women visitors but apparently equally popular with the men, accounted for some of the absentees, but the principal reason seemed to be that every organization or individual in the United States has either an office, an agent, or a customer in New York City, and every visitor felt impelled to give at least a half day to this contact. In New Orleans there will be much less of this kind of distraction.

Of the special attractions for a meeting in New Orleans, more later. Meanwhile, readers may be interested in studying the map (see page 307), which shows the location of all the previous Annual Meetings of the Society.

—R. B. S.

HISTORIC NEW ORLEANS

When in 1718 Jean Baptiste le Moyne, Sieur de Bienville planted the flag of Louis XV at New Orleans, 110 miles from the mouth of the Mississippi River, he saw in every direction a dreary expanse of water and marsh.

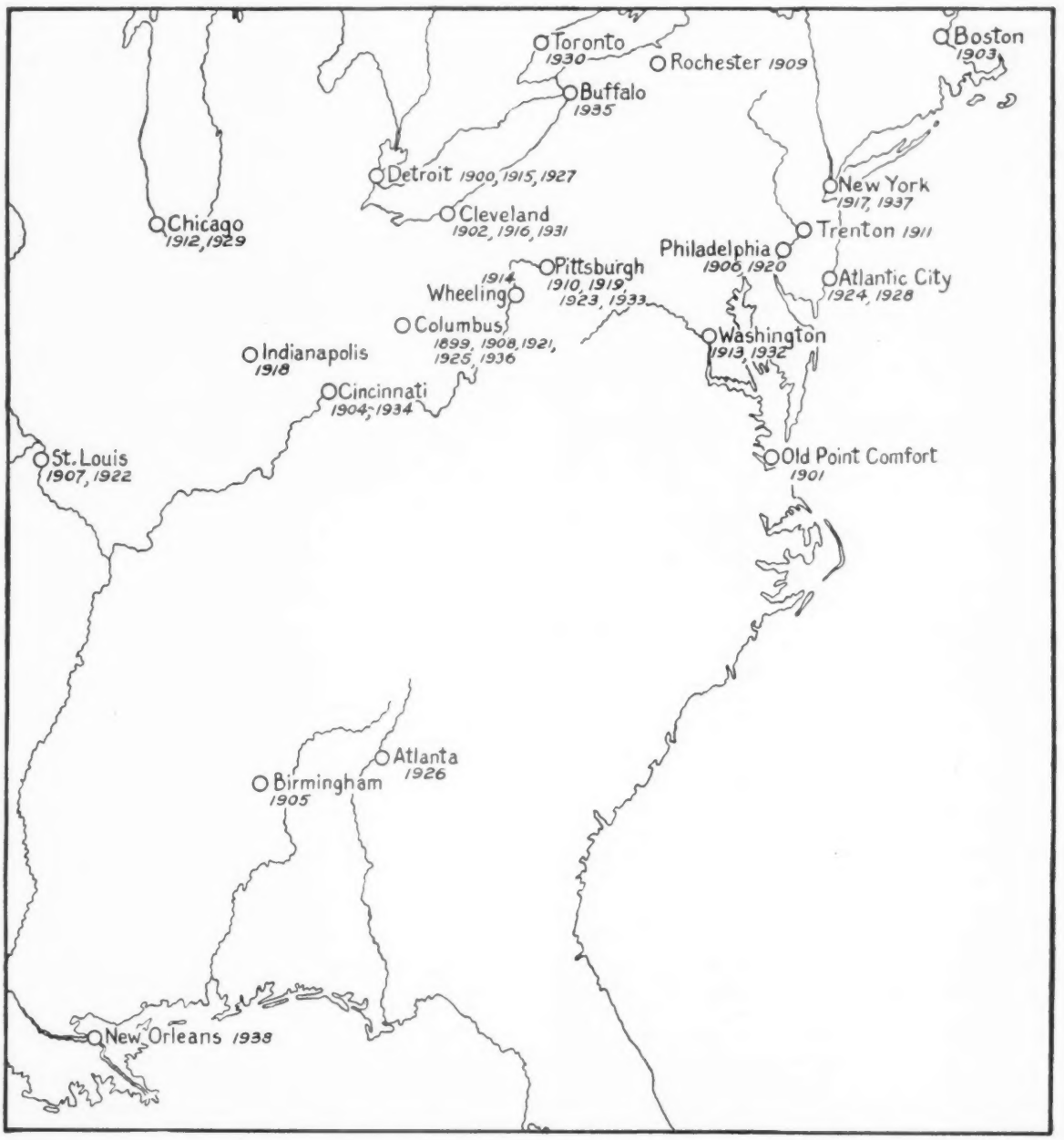
But out of the muck of that marsh, out of the courage and fortitude of valiant men of France and Spain, out of the dreams and toil of early American pioneers, there was slowly built on the site of la Nouvelle Orleans a city that was destined to become the greatest in the South and the nation's second port in value of foreign commerce.

Could Bienville come back to life today, what surprises would await him! He would see his settlement of a few squares transformed into the fourth largest city in land area in the United States. He would see a growth in population from the small band who accompanied him to a citizenship of about 509,000. He would see many monuments to progress and would be surprised to find that New Orleans has preserved for more than a century many of the buildings and the settings around which the romances and the tragedies of his own day were enacted.

Some cities have erected monuments marking the spot where the first settler built the first log cabin or where the first bank or theater was located. But in most cases, these traces of past centuries are lost in the constant metamorphosis of an ambitious and progressive nation. Like other cities, New Orleans has made progress with time; but unlike them it has preserved the old landmarks with the same kind of reverence that inspires its people to bury its dead in marble tombs.

The New Orleans Vieux Carre, which means "old square," but which is now better known as the "French Quarter" is almost the same today as it was when it was erected more than a century ago. This is the New Orleans as laid out by Bienville. It extends from the Mississippi River for eight blocks to Rampart Street; and from Canal Street for thirteen blocks to Esplanade Avenue, where the troops used to drill.

The first citizens of New Orleans were not frontiersmen but aristocrats of France and Spain and they had a vivid model by which to build their new homes and buildings. The French constructed wrought-iron balconies and decorated the interiors with many drapes and chandeliers. The Spaniards built high-walled gardens and patios and narrow alleys. The churches, streets, ballrooms, public buildings—all were in the image of an already well-advanced civilization transplanted in the new world.



Location of American Ceramic Society Annual Meetings 1899–1937

Accordingly, in the Vieux Carre there is the distinct atmosphere of old France and of old Spain. The architecture can best be called "Creole," since it is a combination of French and Spanish influence and is characterized by broad arches, overhanging balconies supported by delicate cast and wrought-iron lacework, fan windows, high ceilings, patios, and myriad-shaped roofs and chimneys. The streets are narrow—among the narrowest in the country—because these early Orleanians saw the wisdom of having the homes on one side of the street get the benefit of the shade made by the buildings on the opposite side.

Thus, in the year when the colonies were protesting British treatment, New Orleans was an established, modern city—a miniature Paris in tone and appearance. And many of the relics of those days have been preserved.

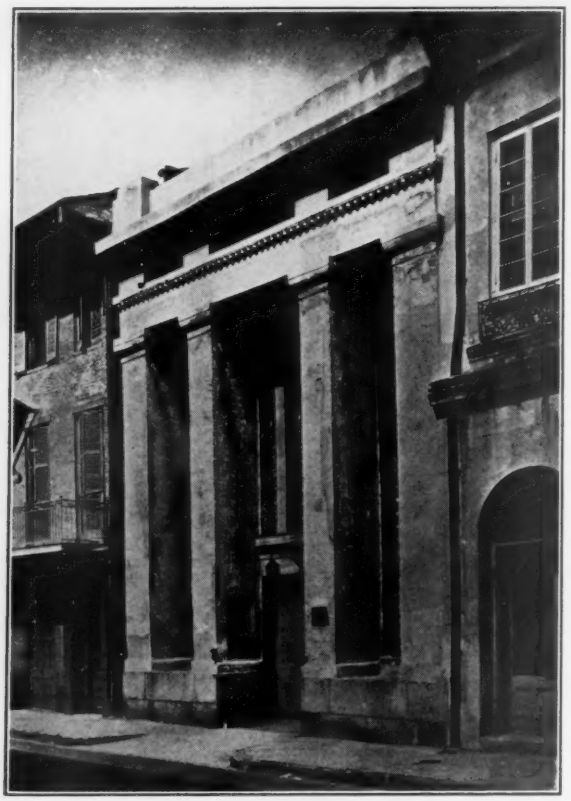
The heart of the Vieux Carre is Jackson Square, known originally as the Place d'Armes. In this Square the early inhabitants would assemble on Sundays to hear the announcements made by public officials from the steps of the parish church which later grew into the St. Louis Cathedral, built in 1794 and in use today.

The greatest real estate transaction known was consummated in the Cabildo, which adjoins the Cathedral. The Cabildo, the form of government under Spanish rule, was erected in 1795 and was the scene of the transfer of

Louisiana from Spain to France to the United States. The Louisiana territory at that time comprised what is now all or part of seventeen states in the Mississippi Valley; thus New Orleans was the cradle of Mississippi Valley civilization. The old building now houses the interesting exhibits of the Louisiana State Museum, including the famous Napoleon death-mask.

On the upper and lower sides of Jackson Square are the Pontalba Apartments, America's first apartment buildings. They were erected in 1850 by the Baroness Pontalba, daughter of Don Almonester y Rexas who built the Cathedral and the Cabildo. Such notables as Jenny Lind and Thackeray lived in these buildings, which today carry in the balcony the initials AP of the Almonester-Pontalba families.

Just off the downtown-river corner of Jackson Square (directions in New Orleans are not indicated by *north, south, east,* and *west* but by uptown and downtown, river, and lake) is the French Market which is of peculiar interest because of the many nationalities found there, the quaint dress, the varied languages, the stalls with their picturesque array of fruits and vegetables, meat and seafoods, and coffee shops. The market is now being rehabilitated, but in the new market much of the atmosphere and architectural oddities of the old has been preserved.



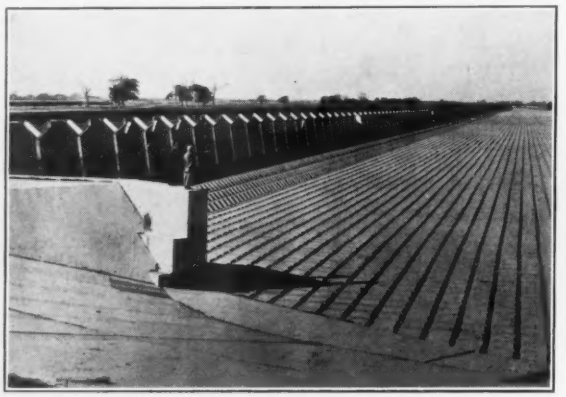
Spanish Arsenal, New Orleans

This unique building, located behind the famous Cabildo in the New Orleans Vieux Carre was erected in 1838 on the site of the old Spanish Arsenal, which as far back as 1770 was used as an armory.

The present building was originally used by the Louisiana Legion, an aristocratic military organization whose officers and members were representatives of prominent Creole families.

It was from this building in 1846 that the Orleans Artillery marched off for their valiant service in the Mexican War. During the Civil War, the building was occupied by Federal troops. In 1874, it figured conspicuously in the celebrated White League battle with the Metropolitan police.

In 1914, the building was transferred to the State Museum and now houses many interesting relics of the days of long ago.



Bonnet Carre Spillway

The Bonnet Carre spillway, located 32 miles above New Orleans, was built by U. S. Army Engineers to take water from the Mississippi River at flood stages and place it in Lake Pontchartrain.

The spillway has a length of 7700 feet at the river. It is 5.7 miles long and is 12,000 feet wide at the lake. It has a capacity of 250,000 cubic feet of water per second, greater than that of Niagara Falls. The cost of the structure and the bridges over it amounted to $13,000,000.

The spillway proper, shown in this picture, consists of a weir divided into separate needle-controlled openings by piers spaced 22 feet on centers, a rear concrete apron protected by riprap, a concrete fore apron with dentiled baffles, and an articulated concrete slab talus six inches thick bearing on layers of riprap and gravel.

Rumors, circulated early in 1937, that New Orleans was in danger of floods were absolutely groundless, the crest of the river reaching a point some two feet under what it was in previous years.

There are scores of other places in the Vieux Carre which are rich in tradition and which remain to tell their colorful stories of yesterday. For example, the archbishopric, erected in 1727, and the oldest building in the Mississippi Valley; the Napoleon House, said to have been built as a refuge for Napoleon after his expected escape from St. Helena; Madame John's Legacy, the typical French architecture of which inspired one of George W. Cable's novels; and many others.

It is interesting to note that sidewalk is called "banquette" by many in New Orleans; that the building in the French Quarter or where the notorious quadroon balls were held is now a "negro convent"; that an old race track is a beautiful cemetery; and that jazz music originated in that city which was the home of the French Opera in America.

It is also interesting to note that the Battle of New Orleans was fought after the treaty of peace in the War of

1812 was signed, yet it is considered the second most important military event in this country's history because it decided forever the ownership of most of the Mississippi Valley.

The Battle was fought at Chalmette which is located a few miles below the city and which holds great interest to the visitor in search of historic associations. A monument, in the style of the Washington shaft, marks the spot where the American standard was planted; a national cemetery is located there. A movement now is under way to have Chalmette made into a national park in commemoration of the great victory won by Andrew Jackson, who was given the valiant support of Jean Lafitte and his band of pirates.

One of the most prosperous eras ever known to American agriculture, in the heyday of sugar cane, has left all around New Orleans its imprint in many fine plantation manor houses. Many of these old homes, characterized by their wide galleries with huge columns, with large halls and numerous rooms, with hand-carved stairways, and with high, ornamented ceilings remain today.

In what is known as the Garden District are to be found homes that are different from those found in most other cities. Many of these ante-bellum homes are still occupied by the descendants of the original owners, who would part with them only as their last earthly possession. One held interest because it was built without nails. Another was built in 1859 by Gallier, Jr., for Captain Leathers who designed the famous *Natchez* which raced the *Robert E. Lee* in that memorable steamboat race up the Mississippi. Another was built in the early 50's and was the place where Jefferson Davis died and where his daughter made her début. Scores of others have colorful old stories to tell.

Yes, New Orleans is interesting inside and outside. It is different from every other city in this country and much is in store for visitors who go there.

Heart of New Orleans

The Place d'Armes, where the Mississippi Valley development had its beginning in 1718, when New Orleans was laid out by Bienville.

Buildings left to right: Cabildo, erected in 1795 and the scene of the transfer of Louisiana from Spain to France and from France to the United States in 1803; St. Louis Cathedral, built in 1794 on the site of Louisiana's first church; Presbytery, used originally by the Cathedral priests; Pontalba Apartment, one of the two rows of brick apartment style buildings, oldest in this country, erected by the Baroness Pontalba. In the foreground is Jackson Square where in 1769 the flag of Spain displaced that of France, the flag of France displaced that of Spain, and the American flag displaced that of France in 1803. In the center of the square is the Jackson Monument, designed by Clark Mills and unveiled in 1856.

The Cabildo and the Presbytery now house historic and natural history museums.

NECROLOGY

C. J. KIRK, 1858–1937

With the death of C. J. Kirk the ceramic industry has lost one of its outstanding pioneers. Born October 13, 1858, on a farm on the outskirts of New Castle, Pa., he spent the first ten years of his life on this homestead (his grandfather having moved to this site shortly after the Revolutionary War to take up a grant of the Continental Congress). The family then moved to Mahoningtown, now a part of New Castle, where he attended the public schools and later the Eastman Business College at Poughkeepsie, N. Y. He also attended Oberlin College and was graduated from that school in 1873.

Returning to New Castle in 1876, he started in the clock and watch-repairing business and although he did not follow in this field after two years of apprenticeship, this training gave him a life-long hobby and aided him in working out his numerous inventions.

In 1880 his father, a sufferer from asthma, moved to Montana, and Mr. Kirk took over his half interest in the Kirk & Dickson hardware store. In 1881 he was married to Katharine Effie Peebles, daughter of Dr. J. H. Peebles of New Castle.

As a young business man Mr. Kirk took an active part in the civic affairs of New Castle and was instrumental in getting its first paved street. He tells about this in a brief autobiography he wrote shortly before his death: "Our streets were partly paved with cobblestones at this time (about 1885) and it was impossible to ride after a rain or in muddy weather. . . . . " He refers here to the old-style high wheel bicycle which was then in vogue, ". . . . . so we formed the New Castle Cycle Club and elected three of our members to Council, Oliver Brown, Hiram Miller, and myself, for the purpose of getting good paved streets."

Before the streets could be paved, however, they found it necessary to put in a sewage system, and Mr. Kirk secured, after some opposition, the services of Colonel Waring of New York. In this way New Castle has the distinction of having the first complete Waring system of sewage in the country.

Mr. Kirk continues, "We paved Washington Street with vitrified brick and it was one of the first of its kind in the United States. Cement at this time was all imported and cost about $5.00 a barrel and was not considered practical.

I, however, put down a cement sidewalk which was the first in the city."

Mr. Kirk also tells of his part in starting the wire-nail industry in New Castle. In 1884 there was a puddler's strike and it was impossible to get the wrought iron or "cut" nails. He had heard of a firm near Pittsburgh that had recently imported machines from Germany to make wire nails, and through his efforts he got this industry to come to New Castle. This company later became part of the Carnegie Steel Company.

A little later Mr. Kirk became interested in the manufacture of gas engines. John Connelly, who was in charge

Charles J. Kirk

of the gas plant, developed and patented a gas engine and organized a company to make these engines. "This was one of the first gas engines built in the United States and was rather crude. It did not have electric ignition, but the charge was ignited by a rod running through the top of the cylinder which was kept red hot by a Bunsen burner."

Mr. Kirk also tells about Mr. Packard's early experience with the Packard automobile: "Our hardware store was equipping an apartment building in Warren, Ohio, for Mr. Packard, who was at that time making the new (Edison) electric-light globes and electric cables. I showed him the gas engine and he wanted to know why it could not be attached to a buggy. I thought it would be too heavy, but he made a small one and put it in his road wagon, connecting it to the rear axle with a loose belt and pulley. It was started by pulling down a lever attached to the belt tightener. He asked me over for a ride and we attained the speed of about ten miles an hour, holding our breath and hats, and thought we were flying. I understand they still have this original car in their showroom in Detroit."

About 1892 the New Castle Forge & Bolt Company had been organized, with Mr. Kirk as one of the stockholders. The company did not prosper and several years later the other stockholders induced Mr. Kirk to take over the active management. He, therefore, sold out his interest in the hardware store and entered the manufacturing field.

During his management of this company he heard of Sherard Cooper Coles' invention of a new process for rust-proofing iron and steel parts and secured the American rights for this patent. He then organized the United States Sherardizing Company which licensed manufacturers to use this process, and this company flourished until the patent expired some time ago.

Beginning of the Universal Sanitary Manufacturing Company

Mr. Kirk came into the pottery industry through a series of circumstances which can best be told in his own words:

"I was president of the Chamber of Commerce when a couple of Englishmen came from Trenton, N. J., and wanted to organize a company to manufacture plumbers' earthenware. I looked into the matter and found that there was a good market in Pittsburgh, Cleveland, and Buffalo, and we decided to organize the Universal Sanitary Manufacturing Company. It was during prosperous times (1899–1900), and the stock was subscribed to at once. As I had been the chief promoter, I was made president, and J. W. Knox, who had been in the glass manufacturing business, was treasurer and general manager.

"After the Universal Company had been operating for some time, Mr. Knox came to me and said his wife was ill and he wanted to take her to Florida for a couple of weeks and asked if I would look after the pottery while he was away. I told him I had a man-sized job looking after the New Castle Forge & Bolt Company. It was just at the time the steel freight car business was getting under way and we had more orders than we could fill. However, Mr. Knox said they had a very competent young lady in the office, plenty of orders on the books, the plant was well managed, and all I would have to do would be to drop in once in a while and see that everything was going all right.

"Mr. Knox went to Florida and over to France, and I soon discovered by auditing the books that the company, by not having sufficient output, was losing money instead of making money. Mr. Knox did not return for over six months and, as I had asked my friends to put their money into this venture and had some of my own money in it, I found myself in the pottery business."

Mr. Kirk found, as many potters had before and have since, that the going was rather difficult. The sanitary industry was centered in Trenton, N. J., and it was hard to get competent workmen. About 1903 he heard that a pottery in England was making sanitary ware by a casting method instead of pressing and Mr. Kirk immediately set to work to try it. However, due to the more complicated shapes—American practice called for the syphon-action bowl whereas in England they were still using the washout-

type fixture—it proved to be a difficult problem. In 1907 Mr. Kirk took out his patent for the "unit cast" method and, with this development work and subsequent refinements, laid the foundation for the present-day casting practice in the sanitary pottery field.

In 1911 the Universal Pottery was destroyed by fire and, in the rebuilding and rehabilitating, W. S. Kupfer became associated with Mr. Kirk.

In the firing of sanitary ware, Mr. Kirk felt there was great room for improvement for, as he often expressed it, the periodic or beehive type of kiln had been used since the days of the Pharaohs in Egypt and the only change had been to make them larger and more wasteful. He heard of Conrad Dressler's work on continuous kilns in England and induced Mr. Dressler to come to America. In 1915 the first Dressler kiln in America was built at New Castle and was the first in the world to be used for firing sanitary ware.

There were many misgivings as to whether sanitary ware could be fired successfully in a continuous kiln, and for a while it looked as though these misgivings were correct. Mr. Kirk, however, believed implicitly in the principle of continuous firing, worked his way out of the difficulties, and this kiln was used successfully from 1916 to 1927. Mr. Kirk's interest in kilns led to his developing and patenting the "twin" or "counterflow" type which bears his name.

The success of this first kiln induced Mr. Kirk and Mr. Kupfer to organize the American Dressler Tunnel Kiln Company. At the start the special refractories were made at the plant of the Universal Pottery where Mr. Kirk applied the experience he had gained with casting sanitary ware to the manufacture of refractories. The demand for these refractories became so extensive, due to the sale of Dressler kilns, that eventually the New Castle Refractory Company was organized to make these parts.

His next pioneering activity was in the field of humidity drying. Previously it had taken from six to eight days to dry sanitary ware after it was cast. Mr. Kirk, in connection with Procter and Schwartz engineers, introduced the principle of humidity drying and reduced the drying time to about twenty-four hours. This was in 1921.

As interested in merchandizing as manufacturing, he early saw the need of better designs for sanitary fixtures and, in 1922 Universal Sanitary Manufacturing Company introduced "Colonial design" for bathroom fixtures, which has since become basic to the industry. Also in 1926, after a year of experimental work, he introduced sanitary ware in colored glazes, an innovation that met with ridicule at first but has since become widely adopted.

Along with other potters in the sanitary field, Mr. Kirk saw the possibilities of the one-fire process, but experiments over a period of fifteen years met with one failure after another. Finally, through the development of better glazing technique and the constant improvement in the casting process his efforts were rewarded in 1927. Of all his achievements in the ceramic field, Mr. Kirk considered once-fired sanitary ware to be the most difficult and probably the most worth while.

Shortly after this Mr. Kirk retired from active management at the Universal but kept his interest in development work, which included experiments on quieter closet combinations and a new type of valve for closet flush tanks, and was busy with these and other developments until shortly before his death.

Joined American Ceramic Society in 1912

Although failing in health for some time he kept up an active interest in the affairs of the American Ceramic Society and attended the Thirty-Ninth Annual Meeting in New York where he enjoyed the meetings and the social activities. Mr. Kirk became an Associate Member of the Society in 1912, and was elected to Active Membership in 1917, and was a Fellow of the Society.

Early in May he was stricken, but his mind remained clear to the last, and he died at the Jameson Memorial Hospital on May 29, 1937. He is survived by his widow, Effie Peebles Kirk, and daughters, Mrs. Thomas Liggett, Jr., of Jenkintown, Pa., and Mrs. W. Keith McAfee of New Castle; one son, Herbert S. Kirk; and six grandchildren.

Mr. Kirk enjoyed a long and eventful career. He was constantly striving to make improvements in every field that he was interested in and nothing pleased him better than to work through to a successful conclusion some new idea or process, especially if he had been told that it could not be done. His outstanding characteristics were his courage and enthusiasm and his unfailing cheerfulness, even in the face of very considerable difficulties. He had, indeed, the true pioneer spirit.

I. B. BRANHAM

Ivan Bundy Branham, Altadena, Calif., died suddenly at his home, May 29, 1937.

Mr. Branham was born in New Philadelphia, Ind., thirty-six years ago. His early life was spent at Urbana, Ill., and he was graduated from the University of Illinois in the Department of Ceramic Engineering. Most of the past fifteen years he had been employed in his profession, and at the time of his death was associated with the Clay Craft Company, Los Angeles.

Mr. Branham joined the American Ceramic Society in 1922, and had carried his membership continuously up to his death. He was a member of Alpha Chi Sigma fraternity and of the American Chemical Society.

OVERBECK MEMORIAL POTTERY EXHIBIT

A memorial exhibition of the work of Elizabeth G. Overbeck,[1] Margaret Overbeck, and Hannah B. Overbeck

was held in the Cambridge City, Ind., public library, May 16, 1937.

The exhibit was not only a memorial to the three sisters

[1] For a life sketch and photograph of Miss Elizabeth G. Overbeck, see *Bull. Amer. Ceram. Soc.*, **16** [2] 67 (1937).

who, with the surviving member of the family, Mary F. Overbeck, founded the Overbeck Pottery in 1911, but it was also a retrospective display of designs, together with the finished product, selected from all the different periods of work in an art enterprise that brought the Overbeck sisters into note in many leading art centers of the country.

Because of their ability to create unusual shapes and colorful designs that are beautiful, artistic, and individual and because of an equal ability and skill to carry out their imaginative designs and to give permanent form to them in potter's clay, they have had no imitators.

CERAMIC SCHOOL NOTES

PRESENTATION OF JOHN CLYDE HOSTETTER FOR THE DOCTOR OF SCIENCE DEGREE AT THE 1937 COMMENCEMENT OF ALFRED UNIVERSITY

By M. E. Holmes

Mr. President:

In accordance with Alfred University's policy of recognizing, with an honorary degree, distinguished careers in the ceramic profession, I have the honor of presenting for the Doctor of Science degree a member of that profession who is eminently worthy.

Since 1908, when he was graduated from Bucknell University, he has occupied positions of a technical and also a highly responsible executive character with his Alma Mater, the National Bureau of Standards, the Carnegie Institute, and the Corning Glass Works, with this phase of his career culminating recently in his appointment to the vice-presidency of the Hartford-Empire Glass Company in charge of research. With their increasing responsibilities, these successive promotions to one of the highest positions of its kind in the country testify to his ability to direct and coördinate the work of others.

As an inventor and originator of many industrial products, he has contributed materially to the advancement that the ceramic industries have made in recent years. New products, better products, and cheaper products are the results of his efforts by which not only the manufacturer but the public benefits. These accomplishments have extended to several fields, but the glass industry has been the chief beneficiary. This phase of his career has recently culminated in the important part he took in the casting of the famous 200-inch telescope mirror.

But his sphere of service has entended beyond the limits of the industrial companies and institutions with which he has been connected. As the author of many scientific and technical publications, he has contributed materially to the present high standard of American scientific literature and to the advance of American science. Wherever the ceramic profession is practiced he is known, his contributions to science are used, and his distinguished leadership is recognized. This recognition has been expressed by his election to the Fellowship, the Trusteeship, and the Chairmanship of the Glass Division of the American Ceramic Society, with this phase of his career culminating in 1935 by his election to the highest office in that Society, the Presidency.

This record testifies to a personality and character representative of the highest type of citizenship. Recognition of these qualities, as well as his material attainments, has already been made by honors of various kinds, including an honorary degree by his Alma Mater. This phase of his career to date culminates on this occasion, when in recognition of a distinguished career and in grateful acknowledgment of his ceramic services, I present John Clyde Hostetter for the honorary degree of Doctor of Science.

THE NEW YORK STATE COLLEGE OF CERAMICS

During the academic year, 1936–37, the New York State College has brought to a close the expansion and reorganization program which has been under way for five years. The institution is now essentially an institute of technology and engineering, although no neglect has been given to the ceramic art and design work which was formerly the dominant feature.

The enrollment the past year was 330, including freshmen, sophomores, juniors, and seniors, about equally divided between the departments of general ceramic technology and engineering, glass technology, and ceramic art. The enrollment has been kept down to this figure for the past three years by rejecting applicants of low scholastic rating in high school and of low adaptability to ceramic work. The facilities of the college do not permit a larger enrollment.

The graduating class this year consists of 19 general ceramic technologists and engineers, 16 glass technologists, and 10 ceramic artists.

Student Branch Activities

The Alfred Student Branch of the American Ceramic

Society has been active under the leadership of Edward E. Kunzman. Regular monthly meetings have been held with an average attendance of more than 100. The Branch has had as guest speakers Heinrich Ries, Louis Navias, Grover Lapp, G. W. Morey, A. I. Andrews, and others. This group has become an important part of the ceramic college organization.

Other Activities

The Keramos Society, under the leadership of Daniel Kocher, has been active the past year. Discussions led by faculty members have been initiated, with the result that much interest has been displayed. George Crawford was elected an honorary member and six student members were initiated.

The St. Patrick celebration on March 18 and 19 was again a real success. It was the occasion of visits by ceramists from the industry in larger numbers than previously. The Board of Directors of the Ceramic Association of New York and the Board of Directors of the Brick Manufacturers Association met in Alfred at that time and joined in the festivities. H. B. Dubois, L. I. Shaw, Samuel Walton, and H. G. Schurecht were knighted by the students.

Ceramic Experiment Station

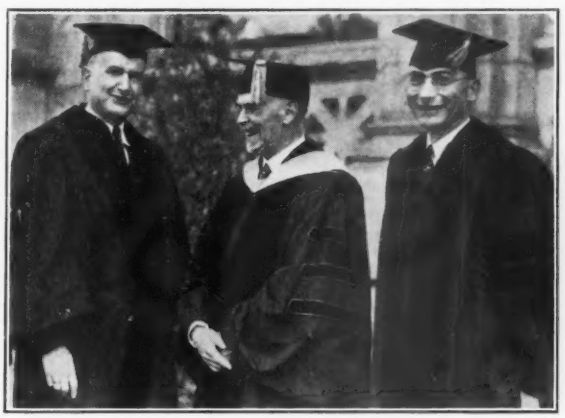
The Ceramic Experiment Station of the New York State College of Ceramics was established the past year and has been in full operation eight months. The staff consists of H. G. Schurecht, professor of research, J. F. McMahon, assistant professor of research, and C. Major Lampman, assistant. Monthly reports have been sent to the 180 ceramic industries in New York State, and thirteen papers were presented at the Thirty-Ninth Annual Meeting of the American Ceramic Society.

Ceramic Art

The work and staff of the Ceramic Art Department has been completely reorganized. Industrial ceramic design is now the training offered. C. M. Harder has been appointed professor of ceramic art and acting head of the Art Department. Donald Schreckengost has been promoted to the professorship of design. Miss Clara Nelson has been appointed assistant professor of drawing, and Miss Marian Fosdick will continue as professor of ceramic art.

Ceramic Association of New York Prize

The Ceramic Association of New York this year initiated the practice of awarding a prize for the best senior research thesis submitted by students in the Department of General Ceramic Technology and Engineering and in the Department of Glass Technology. The prize this year was won by Edward Kunzman.



Honorary degrees of Doctor of Science were presented at the Montana School of Mines to Doctor Wheeler and Doctor Wilson on June 5, 1937. *Reading from left to right:* Burton K. Wheeler, Senior United States Senator from Montana; Francis A. Thomson, President, Montana School of Mines; Hewitt Wilson, Director of the Ceramic Engineering Department, University of Washington.

Ohio State University Student Branch for 1937

PETER McGIL McBEAN CO-FOUNDER THE GLADDING, McBEAN, AND COMPANY

There is a letter preserved in the files of Gladding, McBean, & Company, written by its first President and giving in a few clear, concise sentences the story of the founding of the Company. The letter was written by Peter McGil McBean, one of the three co-founders,[1] all residents of Chicago, who were attracted to the site of the Company's first factory by an article appearing in an early California periodical telling of the discovery of fireclay deposits in the little town of Lincoln in Placer County. Its chief interest is, of course, historical, but beyond that it gives real evidence of the courage, practicability, and vision of those men who laid the foundation for the Company's growth from a small beginning to the immense institution now existing.

Partnership Papers Signed in 1875

Mr. McBean tells us that the co-partnership papers were signed in Chicago on May 1, 1875. The capital of the firm consisted of $12,000 which was exchanged, on arrival in California, from currency to gold at discounts from 12½ to 15%. The first press with dies and a set of roller crushers was ordered shipped to Lincoln, and it is interesting to note that the freight on the shipment amounted to $595.05, or one-third of the cost of the machinery. The machinery arrived in Lincoln on June 24, 1875, and forty-six days later, the first carload of vitrified sewer pipe was delivered in San Francisco.

Lincoln Plant

The business grew steadily and soundly. In a short time, orders were filled not only for San Francisco and other bay cities, but also for Los Angeles, San Diego, Portland, Seattle, and Vancouver. By 1882, there were two buildings at the Lincoln plant, five kilns, and a sixty-horsepower engine with two boilers. Thirty-five men and boys were employed and, although sewer pipe was still the principal product, the plant was also manufacturing well pipe, chimney tops, and a few ornamental and garden pieces.

In 1884, terra cotta for buildings was manufactured for the first time. From that time forward, the history of Gladding, McBean, & Company, insofar as terra cotta is concerned, is a very distinguished part of the building history of California, Nevada, Utah, Arizona, Oregon, Washington, British Columbia, and the Orient.

In its western beginnings, terra cotta was used exclusively for ornament. Gradually its utilitarian merit was recognized and thereupon the industry entered upon a new and much more important epoch. By constantly improving manufacturing processes, the Company has been able to produce terra cotta ashlar in increasingly larger units. The technical staff of the Company places all its skill at the disposal of the architect, and so the range in terra cotta sizes, colors, and textures is constantly widening. This sort of promotional work, founded upon the desire to satisfy the architect, helps to explain the enormous use of terra cotta in the territory which Gladding, McBean, & Company serves.

To produce terra cotta free from warpage has been one of the major problems with which the Company has had to contend for many years. Since warpage usually develops in the drying period, the dry-finishing process was introduced as a solution to this problem and is one of the manufacturing improvements which has made possible the large-scale ashlar blocks found in buildings today.

Atholl McBean

Expansion

Following the development of terra cotta, hollow tile, face brick, roof tile, quarry tile, refractories, paving brick, and decorative and faience tile were manufactured in order, until today the Company offers a complete line of clay products. As in the manufacture of terra cotta, these products have been improved not only by improving manufacturing processes, but by the Company's endeavor to anticipate the needs of the architect and to

[1] The co-founders were Charles Gladding, Peter McG. McBean, and George Chambers.

give him what his design calls for rather than to consult its own prepossessions.

It is generally recognized that the roof tile as developed by Gladding, McBean, & Company has revolutionized the industry and exerted an ineffaceable influence upon architecture. The earlier American roof tile was characterized by careful uniformity of color due to the meticulous sorting of the tile. Gladding, McBean, & Company emancipated the industry from this glaring error and, through intensive experimentation in the laboratory and kiln, produced roof tile which is recognized today as a substantial contribution to American architecture.

Atholl McBean

In addition to the attributes bestowed by his father, Atholl McBean possesses the characteristics of enthusiasm and forward promotional efforts largely responsible for the expansion of the Company's properties. It has been his purpose to expand in advance of demand until today the Company holds strategic positions from Seattle to southern California. He is thoroughly progressive and believes not only in keeping abreast but a little ahead of the times. It was this extra sense of power which exerted itself in his shrewdness in insisting that a vigorous effort be made to increase the volume for other clay products in order to utilize those facilities otherwise idle during the inevitable periods when the demand slackens in some one of the various commodities. Terra cotta wall units and terra cotta unit tile were developed as a result of Mr. McBean's vigilance in this respect.

Terra Cotta

Terra cotta wall units were developed to provide a hollow building tile with a glazed ceramic surface. The units are glazed on the face and scored on the back for plaster and form a complete self-supporting partition. Through improvements such as de-airing and dry finishing, Gladding, McBean, & Company has brought this product to a high degree of perfection. Terra cotta wall units can be furnished in a great variety of colors and finishes and the field for their use is practically unlimited. There is a place for them in buildings of the highest type, and their moderate cost permits their use in the more commercial type building.

Terra cotta unit tile were developed to meet the demand for a tile unit in sizes larger than the usual standard wall tile. The material is an outgrowth of the terra cotta wall unit, but it is a speciality product with each piece designed and numbered for its proper location. Varied shapes with proper mitre and angle pieces have been developed to provide a flexible lee-way in adapting the material to any wall surface. The material is particularly adapted to modernization work for interior or exterior facing and permits a more architectural treatment of store fronts, lobbies, and theater foyers than is possible with the smaller sized tile.

Floor and Wall Tile

Prior to August 1, 1933, the Company operated a comparatively small tile department at the Glendale plant. With the acquisition of the West Coast properties of the American Encaustic Tiling Company, the Company undertook the manufacture of a complete line of floor and wall tile including, in addition to the colored wall and decorative tile, white wall tile, ceramic mosaics, semivitreous glazed, and semivitreous pavers. All of the glazed tile, with the exception of certain types of decorative tile, are manufactured under a patented process to which the Company has exclusive rights in the Western states.

Pottery

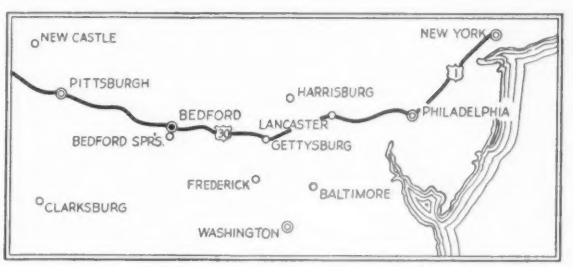
For many years Gladding, McBean, & Company has made a line of garden pottery and furniture which, while quite complete from the standpoint of design and color, has never been featured by the Company as a major product. Early in 1934, the Company established at its Glendale plant a complete pottery department embracing, in addition to garden pottery, a complete line of art pottery and tableware. Introduced under the trade name "Franciscan Ware," on the basis of national distribution, this product has been one of the Company's major lines from the standpoint of sales volume during the last two years. In fact, Franciscan Ware won such national acclaim that the Company was invited to participate in the industrial exhibit at the Metropolitan Museum of Art in New York City.

And so from a claypit in a little foothill town, a great enterprise was born. The Gladding, McBean, & Company of today is a vastly different concern from the copartnership formed in 1875. Its products exhaust every conceivable shape of clay. These are fired in one hundred and eighty periodic and twenty-six tunnel kilns. Its employees number more than two thousand and its assets are over ten million dollars.

DR. TONE AND MR. BOWMAN TO BE HONORED

The famed Carborundum Band of sixty musicians under the direction of Edward D'Anna, which has been heard over the air-waves for the past eleven seasons, will appear at the Great Lakes Exposition at Cleveland to play two concerts on the afternoon and evening of July 24. This will be known as Carborundum Day at the Exposition.

The band will be accompanied by a group of officials of the Company including Frank J. Tone, President. Preceding the afternoon concert hour the Carborundum Company officials will be guests at a luncheon given by the Board of Directors of The Great Lakes Exposition. Dr. Tone and Mr. Bowman will be given honorary titles of Admiral of The Great Lakes.



Bedford Springs, Pa., where Refractories Division will meet, September 3 and 4

FLOYD L. GREENE, PRESIDENT, GENERAL REFRACTORIES COMPANY

Floyd L. Greene, who has recently been elected president of the General Refractories Company, has been actively identified with the refractories industry for twenty-five years. He was general superintendent of the Standard Refractories Company at the time of its acquisition by General Refractories Company in 1922, becoming successively district manager of central Pennsylvania operations, general works manager, vice-president in charge of operations, executive vice-president, and president. He has been a director of the Company for many years.

Mr. Greene is also a director of several of the subsidiaries of the parent Company, a director and member of the Executive Committee of the American Refractories Institute, and vice-president and a director of the First National Bank of Claysburg, Pa.

F. L. Greene

S. M. D. Clapper

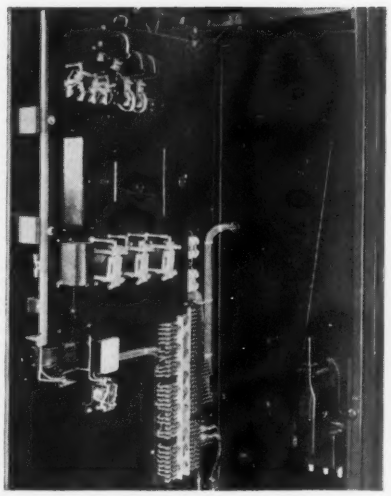
S. M. D. CLAPPER, GENERAL REFRACTORIES COMPANY

Chairman, Board of Directors

S. M. D. Clapper, who has been actively engaged in the management of General Refractories Company since the early part of 1933, was recently elected Chairman of its Board of Directors, to continue the management of its affairs of policy. Mr. Clapper is also Chairman of the Board of Directors of Schlichter Jute Cordage Co., Philadelphia; a director of Central Penn National Bank, Fire Association of Philadelphia; Guaranty Co. of North America, Reliance Insurance Co. of Philadelphia, and Delaware County National Bank of Chester, Pa.; vice-president, resident in Philadelphia, of Cannon Mills, Inc.; and treasurer of Ewing Thomas Corp., Chester, Pa.

NEW ORLEANS *IS* IDEAL FOR ANNUAL MEETING!

1. New Orleans is no farther from the center of industrial ceramics than are the cities on the Atlantic Coast.
2. New Orleans is closer to the eastern cities than is eastern Kansas, which is the geographical center of the United States.
3. New Orleans will cost no more in railroad fare than other cities where Annual Meetings have been held.
4. New Orleans will broaden conceptions of geography, history, and peoples.
5. New Orleans will enable Members to see new ceramic resources and trade opportunities.
6. Meetings held in New Orleans by other technical societies have exceeded all expectations.
7. There is every reason, therefore, to expect that the Fortieth Annual Meeting of the American Ceramic Society will be rich in benefits to its Members as well as the largest in attendance.



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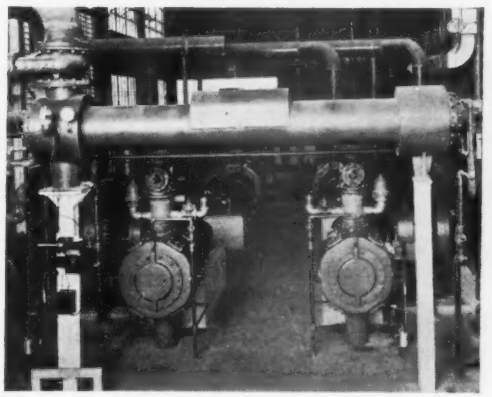

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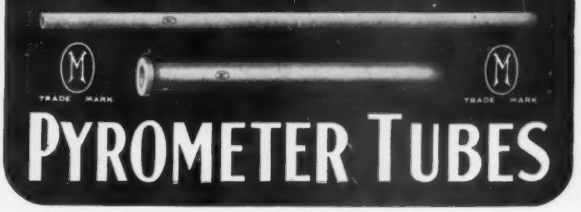

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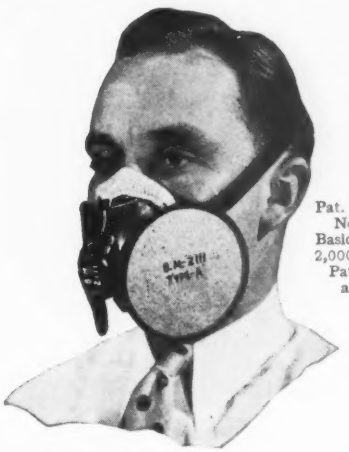

Pat. Dec. 22, 1936, No. 2,065,304. Basic Patent No. 2,000,064. Detail Patents Pending and Allowed.

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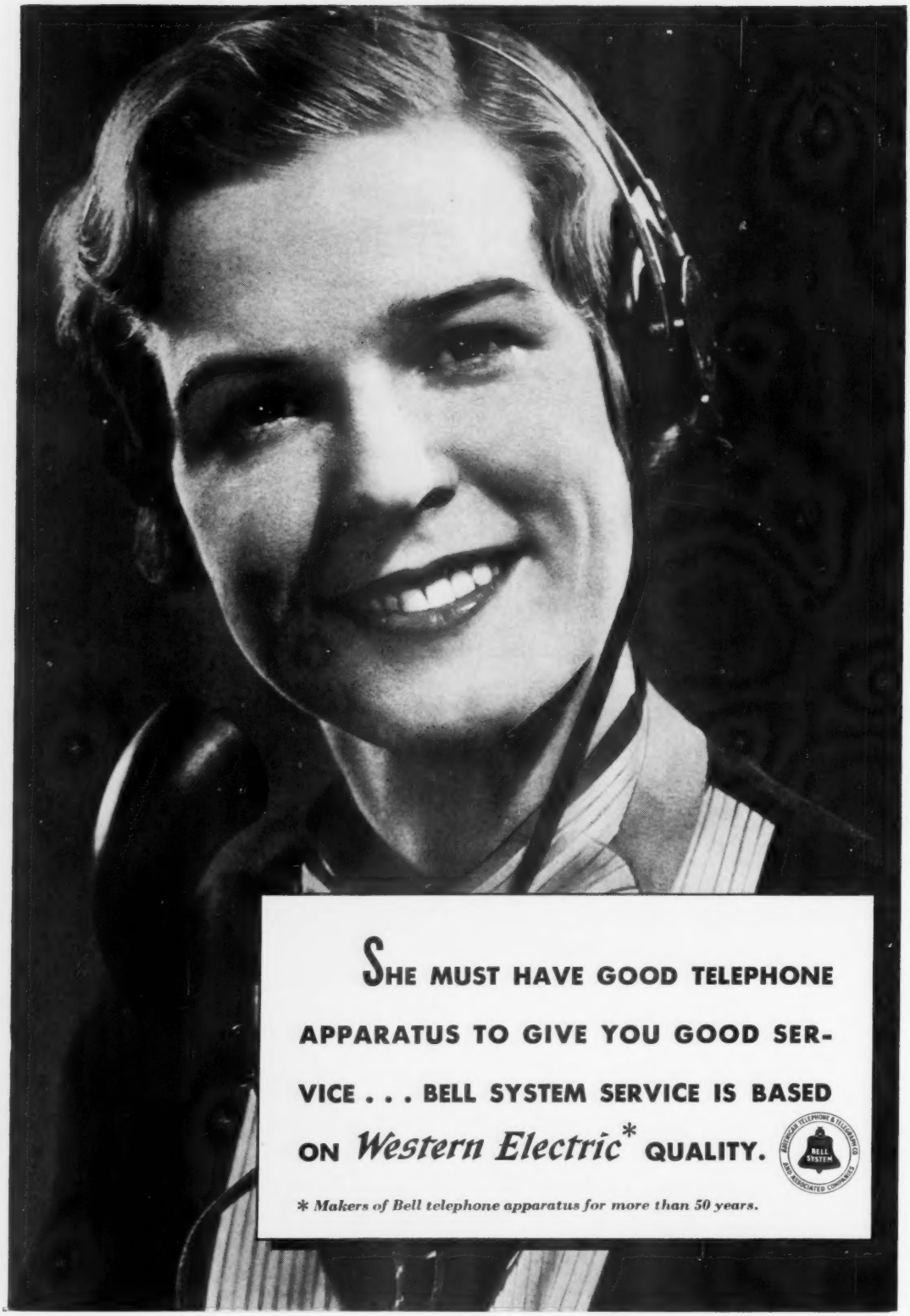
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